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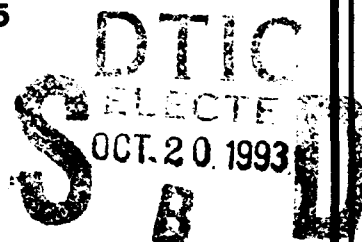
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**LASER RANGE EVALUATION FOR THE GOLDWATER
AIR FORCE RANGE, LUKE AIR FORCE BASE, ARIZONA -
GILA BEND AIR FORCE AUXILIARY FIELD**

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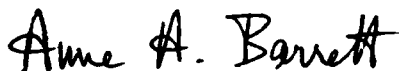
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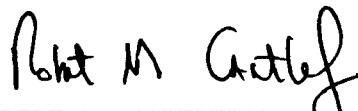
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13. ABSTRACT (Maximum 200 words) At the request of the 58th Medical Group Bioenvironmental Engineer, Armstrong Laboratory personnel performed a laser range evaluation at the Luke Air Force Base Range. The lasers to be used, the various targets as well as the ranges, and finally the missions to be flown were all reviewed in order to assess the laser hazard and establish the Laser Surface Danger Zones (LSDZs). Appropriate recommendations were made for both manned and unmanned ranges. Laser range procedures were detailed as well as required medical surveillance requirements for range personnel and aircrews.				
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**LASER RANGE EVALUATION FOR THE GOLDWATER AIR FORCE RANGE,
LUKE AIR FORCE BASE, ARIZONA - GILA BEND AIR FORCE AUXILIARY FIELD**

INTRODUCTION

The following laser range evaluation was performed at the request of Capt Lynn Borland, Chief, Bioenvironmental Engineering Services (BES), Luke Air Force Base on 27-29 April 1993. The hazard analysis, range evaluation, and recommendations were done in accordance with AFOSH Std 161-10 for the purpose of ensuring range laser safety.

In the case of air-to-ground laser systems and because of the very large size of the range and the large number of targets, we decided to perform a hazard analysis based on an absolute worst case (largest footprint of most hazardous laser system) for a typical target. By rotating this largest footprint around the target we obtain a circular laser surface danger zone (LSDZ) for the unmanned ranges targets, thus allowing the aircrews to use whichever attack heading they wish. For targets on the manned ranges, only two headings are used; therefore, the LSDZ only includes the footprints for these two headings. These LSDZs are quite conservative, but we feel that it should not be a problem because of the large size of the range. This range size will give more flexibility as far as laser operations are concerned (various laser systems and various headings). We will compute the LSDZs to include all the lasers currently used in the United States Air Force (USAF). We do not have at this time the necessary data to make a worthwhile LSDZ computation for other services air-to-ground systems. The operation of ground-to-ground laser systems will be discussed and general recommendations will be made. However, we cannot make any specific recommendations since this type of system is not being used at this time on the range, and we do not know in what configuration they would be used.

We tried to make our hazard analysis as generic as possible to enable more flexible laser operations and also simpler safety procedures. However, our analysis and recommendations are based on the information that was provided to us by the range and operations personnel. Any change that could affect the hazard analysis needs to be reported to Capt Borland (58MG/MGPB) for reevaluation of the laser range operations.

HAZARD ASSESSMENT

Laser Systems

Many laser systems could be used on the Goldwater Air Force Range (GAFR) for ranging and target designating purposes, both air-to-ground and ground-to-ground. The laser most frequently used is the Low-Altitude

Navigation and Targeting Infrared for Night (LANTIRN) system mounted on the F16 and F15E fighter aircraft. But other systems such as the air-to-ground Air Force Pave Spike, Pave Tack, etc., as well as other Army and Navy systems may also be used. Tables A-1, A-2, & A-3 (Appendix A) list all the air-to-ground laser rangefinders and target designators that are used by the U.S. Air Force, U.S. Army, and U.S. Navy respectively. Tables A-4 through A-7 (Appendix A) list all the ground-to-ground laser rangefinders and target designators currently used by the U.S. Armed Forces. These lists include all pertinent and available information for the range evaluation and laser hazard calculations such as the wavelength, the laser classification, the Nominal Ocular Hazard Distance (NOHD), the required optical density (OD), the buffer angle, etc. Appendix B contains a brief description of the USAF air-to-ground laser systems as well as their laser hazard evaluations, and their platforms. The same information is provided for the other services laser systems when available.

For the LANTIRN system, one must also take into account the secondary beam issue. Through reflection of the primary beam from the laser window and subsequent transmission through the forward looking infrared (FLIR) window, there exists a secondary beam which has a NOHD equal to 2000 ft. This secondary beam can exit the pod at angles of up to almost 90° from the primary beam depending on the gimbal position. Therefore, one must take appropriate precautions which will be discussed later.

The Range

Appendix C contains the range maps. Map 1 shows the entire GAFFR (or Luke Air Force Base Range). Maps 2 through 5 show the 4 manned ranges (Range 1, 2, 3, and 4). Maps 6 through 8 show the 3 unmanned or tactical ranges (East Tac, North Tac, and South Tac). These maps include geographic items such as roads, rivers, buildings, towers, etc. as well as the topography of the terrain and finally the location of the targets.

The airspace above the whole range is restricted from the ground level all the way to 80,000 ft.

The Targets

Many different types of targets are used on GAFFR. However, all the targets are static. On the tactical ranges the targets consist mostly of old vehicles and wooden targets. The vehicles are painted with flat olive drab paint, and the glass and chromes are removed to the maximum possible extent. All remaining glass and chromes were painted with the same olive drab paint. All new vehicles now have all their glass and chromes removed prior to being placed on the range as targets. Also more and more targets are now made out of wood to better simulate various threat shapes such as tanks, surface-to-air missiles (SAMs) etc., and also because they are a lot cheaper. Consequently, we feel that the targets are free of specular reflectors. As for the manned ranges, the bombing targets are vehicles covered with a flat white paint and again glass and chromes have either been removed or painted; and the strafing targets are made out of old parachute canopies. There are metal corner reflectors in the vicinity of the targets for the purpose of radar

verification. These corner reflectors should be painted with a flat paint. This will not affect radar performance, but will avoid the possibility of specular reflection of laser light from these reflectors. Also there are some lamps near the targets. Because these lamps have cylindrical glass covers, reflection of the laser beam will be scattered or diffuse. Since we know, from Appendix B, that the diffuse reflection NOHD for air-to-ground laser target designators varies from 0 to 2.08 m, there is no hazard unless personnel stay within 2.08 m of these lamps during laser operations. Therefore, there is no reflection hazard on the manned ranges targets either.

The Mission

Both air-to-ground and ground-to-ground lasers could be used on GAFFR. However, currently only air-to-ground lasers are being used. As was described earlier, we will keep our hazard analysis as generic as possible to provide for more flexibility in the type of laser operations that could be performed at the Luke Air Force Range.

1. Tactical Ranges:

For the targets on the tactical ranges, we will assume that any heading can be used, even though in some cases the nature of the target (convoy) or topography of the terrain will allow only for a limited number of headings. However, new targets could be located elsewhere on these ranges, and this will provide for more flexibility in the use of the lasers. On these targets several delivery profiles may be used (See Appendix D):

a. Loft Delivery Lasing Profile

1. Minimum slant range to target: 12,000 ft (closest release)
2. Maximum slant range to target: 30,000 ft
3. Minimum above ground level (AGL) altitude: 500 ft
4. Maximum AGL altitude: 5,000 ft
5. Angle of Egress from run-in track: $>30^{\circ}$

b. Medium Altitude Lasing Profile

1. Minimum range to target: 8,000 ft
2. Maximum range to target: 14,000 ft
3. Minimum AGL altitude: 8,000 ft
4. Maximum AGL altitude: 15,000 ft
5. Angle of Egress from run-in track: 30° to 60°

c. "Buddy Lase" Delivery Profile

1. Minimum slant range to target: 5,000 ft
2. Maximum slant range to target: 12,000 ft
3. Minimum AGL altitude: 500 ft
4. Maximum AGL altitude: 20,000 ft
5. Angle of Egress: $\sim 45^{\circ}$

These delivery profiles are the ones used for LANTIRN; however, we understand that all air-to-ground delivery profiles are similar regardless of the laser system used or aircraft platform. Other services also use the same type of tactics.

2. Manned Ranges:

On these ranges, only two opposite headings are permitted for each target to provide for ground range personnel safety and proper scoring among other things. The profiles used are the same as for the tactical ranges except for "buddy lasing" which is not authorized on the manned ranges.

The Laser Surface Danger Zone (LSDZ)

All the footprint calculations are in Appendix E, and the graphs showing the LSDZs for all the various cases considered are in Appendix F.

Looking at the footprint calculations at Appendix E, one can see that the worst case or largest footprints are the following for the various delivery profiles:

1. Loft Delivery Profile:

Laser System	Forward	Aft	Width
LANTIRN	4420 ft 1350 m	3420 ft 1040 m	127 ft 39 m
Pave Tack	6500 ft 1980 m	4550 ft 1390 m	176 ft 54 m
Pave Spike	3730 ft 1140 m	4250 ft 1290 m	163 ft 50 m

Table 1. Loft Delivery Footprints

2. Medium Altitude Lasing Delivery Profile:

Laser System	Footprint		
	Forward	Aft	Width
LANTIRN	51 ft 16 m	51 ft 16 m	58 ft 18 m
Pave Tack	71 ft 22 m	71 ft 22 m	81 ft 25 m
Pave Spike	66 ft 20 m	66 ft 20 m	75 ft 23 m

Table 2. Medium Altitude Delivery Footprints

3. "Buddy Lasing" Delivery Profile:

Laser System	Footprint		
	Forward	Aft	Width
LANTIRN	650 ft	587 ft	51 ft
	198 m	179 m	15 m
Pave Tack	921 ft	800 ft	70 ft
	281 m	244 m	21 m
Pave Spike	845 ft	742 ft	65 ft
	258 m	226 m	20 m

Table 3. "Buddy Lasing" Delivery Footprints

Therefore, one can see from the data given in Tables 1, 2, and 3 that the largest footprint is the one for the Loft Delivery Profile using the Pave Tack laser (Footprint: Forward = 6500 ft, Aft = 4550 ft, Width = 176 ft).

In the case of the tactical ranges and from the information contained in The Mission paragraph, we took the footprints for the USAF air-to-ground laser systems and determined a circular LSDZ by rotating the worst case footprint dimension around the target.

In the case of the manned ranges, we computed the LSDZ from the worst case footprints of the two possible headings.

Consequently, one can see that for the tactical ranges targets the LSDZ is a circle with a radius of 6500 ft or 1980 m. For the manned ranges, each target has a LSDZ that is an ellipse with a major axis equal to 13,000 ft and a minor axis equal to 176 ft. Appendix F contains all the graphs describing the LSDZs.

Because of the large number of targets and the many possible headings, we did all our footprint calculations assuming flat terrain. If the terrain is rising, our calculations will be conservative. If the terrain is falling, the actual footprint will actually be larger than for flat terrain, and some modifications in the calculations might be needed. However, the manned ranges targets are on flat terrain, and on the unmanned ranges, the footprint and LSDZ increases should not be a problem since no personnel are present on the ground when missions are flown. This last possibility will be further discussed later in this report.

We also did some preliminary hazard evaluations on some of the Navy's air-to-ground laser systems (see Appendix E). However, at this point we do not have enough information on the beam divergence and buffer angles to make reasonable footprint calculations. We had to use some very large values (worst case) for both divergence and buffer angles; consequently, the preliminary results are both too restrictive and inaccurate. We suggest that you contact us again in the event that Navy or Army air-to-ground laser

systems are considered for use on the Goldwater Air Force Range, so that we can reevaluate these systems accurately.

CONCLUSIONS AND RECOMMENDATIONS

The GAFR personnel need to be commended for their efforts and awareness in the field of range laser safety. They have done a great job ensuring that the targets are free of specular reflectors by painting or removing mirror-like surfaces.

General Recommendations

The following general recommendations are made to ensure safe laser air-to-ground operations on GAFR on both manned and unmanned ranges:

1. Lasers should only be fired at targets for both ranging and designating purposes. Lasing of nontarget vehicles or aircraft is strictly prohibited, except in the case of the LANTIRN 1540 nm training mode.
2. Laser operations must be immediately stopped if personnel are observed in the LSDZ, equipment malfunction is observed, target is lost in field of view, or anytime laser safety cannot be assured.
3. The LSDZs must be free of specular reflectors such as shiny metals, glass, and other mirror-like surfaces to the maximum extent possible. In case of flooding, all standing water must disappear from the LSDZs before laser operations can resume. During periodic maintenance of the range, the LSDZs must be policed for specular reflectors.
4. Make sure that the targets are positioned so that the LSDZs do not extend outside the military range or reservation.
5. As far as medical surveillance requirements are concerned, one must consider two different categories of employees: laser personnel and incidental personnel. Laser personnel are defined as working routinely with lasers while incidental personnel are those whose work makes it possible but unlikely that they will be exposed to laser energy sufficient to damage their eyes or skin. All personnel working on GAFR (i.e., the aircrews and the ground personnel) fall in the category of incidental personnel. For this type of personnel, the medical examination requirements are:
 - a. Required examinations shall be performed prior to participation in laser work, following any suspected laser injury, and after laserx employment is completed. Periodic examinations are not required. Please note that medical surveillance is not required for personnel using ANSI Class 1, 2, 2a, or 3a lasers, but required for Class 3b and 4 lasers users.
 - b. Only visual acuity measurement is required. This examination should be performed by, or under the supervision of an ophthalmologist, optometrist, or other qualified physician. Visual acuity for far and near vision should be measured with some standardized and reproducible method. Refraction corrections should be made if required for both distant and near test targets. If refractive corrections are not sufficient to change acuity

to 20/20 (6/6) for distance, and Jaeger 1+ for near, a more extensive examination is indicated. The part of ANSI STD Z136.1-1993 pertaining to medical surveillance and describing further medical examination requirements is included in Appendix G of this report.

These medical surveillance requirements are those prescribed by the ANSI STD Z136.1-1993 with an additional post-laser employment medical examination required by the Air Force. The current AFOSH STD 161-10, dated 30 May 1980, contains different requirements, but the new Air Force policy is going to endorse the ANSI STD Z136.1-1993 requirements on the topic of medical surveillance, and only require a laser work termination medical examination in addition. This new policy on laser medical surveillance will soon be made official in a policy letter from HQ AFMOA/SGPA and also by the revised AFOSH STD 161-10 which we expect will be published in the spring of 1994.

Because all Air Force military personnel receive this type of visual acuity examination when they enter the Air Force, this should be already adequately documented in their medical record, and there is no need to give them this examination again. In the case of Air Force civilian personnel there might be a need to give them this eye examination if they have not had it during their Air Force employment.

6. The control of the range and airspace must be coordinated with the appropriate organizations for all range laser operations.

7. Because the laser hazard zones are within a designated weapons and gunnery range, laser warning signs are not required on the GAFR perimeter fence; however, access controls to these laser hazard zones are needed. The current system of radio communication is quite adequate for this purpose.

8. Laser safety training is essential for both aircrews and ground personnel. This training is the responsibility of the Range Safety Officer and the support Military Public Health Officer. The assigned flight surgeon and BES can assist in parts of this training. Initial and annual training should be conducted and properly documented. Training material can be obtained from AL/OEOE (Capt Barrett), DSN 240-4784, at Brooks AFB.

9. No laser should be fired above the horizon.

Specific Recommendations

In addition to these general recommendations, one must also consider the following procedures specific to the manned and unmanned ranges, as well as air-to-ground and ground-to-ground laser systems.

1. Manned Ranges:

On these ranges, ground personnel are present during bombing, strafing, and lasing operations; therefore, one must take the following additional precautions to ensure their safety from lasers.

a. Aircrews must call "Laser On/Off" to ground tower personnel every time they fire the laser.

b. Looking at the LSDZs for the manned ranges targets shown in graph 3 of Appendix F, one can see that the towers are actually far from the LSDZs. However, this assumes the aircrews are careful to lase only the targets and fly the right attack pattern with straight run-in starting 10 NM (nautical miles) from the target. In the very improbable event that these precautions would not be observed and one of the towers be illuminated by the laser, the tower personnel are equipped with laser eye protection. The required OD for unaided viewing (meaning bare eyes, no optics used such as binoculars, telescope, etc.) is 4 for $\lambda=1064$ nm. The ODs listed in Table A-1 of Appendix A are for exposure at the laser aperture, and thus 4 is a quite adequate value (even Pave Tack requires only 2.7 OD at 100 m range per our calculations).

Also the tower personnel use a scope for scoring ($G=4$) with a magnifying power of 2, according to the information that was given to us by the tower personnel. In this case, they need increased eye protection, and the OD needs to be increased by 0.602. Therefore, an OD of 4.602 is required when viewing through the scoring scope. Because wearing laser eye protective goggles or spectacles does not enable the operator's eye to be close enough to the eyepiece and thus decreases the field of vision to the point where scoring may not be possible, we suggest rather that filters be installed on the scope to reduce the radiant exposure to levels below the MPE.

2. Unmanned Ranges:

On these ranges, there are usually no personnel present on the ground during flying operations. However, it is possible that certain maintenance projects may be performed on a part of the range while flying and lasing operations occur on another part of the range, so that aircrew training time is reduced as little as possible. In that case, the following precautions must be observed:

a. Aircrews must be warned of the presence and location of the ground personnel.

b. Ground personnel must not be in the LSDZ of the targets that aircrews are training on.

c. Ground personnel must be equipped with laser protective eyewear with an OD of 4 for the 1064 nm wavelength, and must absolutely avoid using any type of magnifying optics such as binoculars, telescopes, etc. during laser operations.

3. Air-to-Ground Laser Systems:

The following recommendations concern the use of air-to-ground laser systems:

a. When using LANTIRN in the combat or operational mode ($\lambda=1064$ nm), and due to the secondary beam, the laser must not be fired under 2000 ft AGL when flying above populated areas (crossing public highways, other active roads, areas with ground personnel, etc.). Also a distance of 2000 ft between aircrafts must be maintained to ensure the safety of the aircrews while lasing.

b. From the tactics that are used on GAFR, there should not be a need for aircrews to wear laser eye protection (LEP) as long as aircrafts remain 2000 ft from each other, aircrews only lase the targets, and "buddy lasing" is used only in the manner that was described to us; i.e., there is no chance that the bombing aircraft will pass in the beam from the lasing aircraft.

4. Ground-to-Ground Laser Systems:

The following recommendations concern the use of ground-to-ground laser systems. However, since we do not have any details at this time on how and where the lasers would possibly be used, we will only include general guidelines in the case that you consider having this type of operations on your range:

a. Ground-to-ground laser target designators and range finders are classified as either ANSI Class 3 or 4. The procedure to determine the LSDZ is about the same as for air-to-ground lasers. However, one can point a ground-to-ground laser system at a target a lot closer than an air-to-ground laser system. Therefore, in addition to specular reflection, one needs to be a lot more concerned with diffuse reflections and skin hazards. Buffer angles also need to be determined differently.

b. If the laser is fired from an elevated platform, the LSDZ should be evaluated using the same procedures as for air-to-ground lasers.

c. If the surrounding terrain is flat or falls off in the distance without backstop, the LSDZ is a cone extending out to the NOHD that covers the target area or beam (whichever the largest) plus a buffer angle all around.

d. If the terrain contains backstops (natural or man-made) which terminate the laser beam within the NOHD, then the LSDZ is contained in that area provided the backstop is high enough to include the beam and the buffer angle. It is therefore a good idea to site the targets in front of backstops.

e. We will be happy to assist you with more specific guidance if and when you decide to have ground-to-ground laser operations on your range, and have more details on the ground-to-ground laser systems that will be used as well as their operating circumstances.

Finally, in the case any other problem or question would arise, range personnel need to get the assistance of the office that is responsible for laser safety: BES.

APPENDIX A

Air-To-Ground Laser Systems
Ground-To-Ground Laser Systems

TABLE A-1. USAF AIR-TO-GROUND LASER SYSTEMS

Device	Wavelength (nm)	ANSI Class	NOHD (km)	NOHD-0 (km)	OD	OD-0	Buffer Angle (mrad)	Beam Divergence (mrad)
Pave Spike (AN/ASQ-153)	1064	4	10.4	73.5	4.02	5.71	2.5	0.35
Pave Tack (AN/AVQ-26)	1064	4	2.3	16.1	5.55	7.24	2	1.8
Pave Knife (AN/ALQ-10)	1064	4	5.6	---	3.7	---	5	---
Pave Spectre (AN/AVQ-19)	1064	4	8.89	63	3.7	5.4	5	0.33
LANTIRN operational training	1064 1540	4 3b	22.7 0	157 0	4.15 0	5.84 0	2 N/A	0.18 0.18

Notes: NOHD-0 - NOHD with optical instruments (7 x 50)
OD-0 - OD needed for optical instruments (7 x 50)
(7 x 50: magnifying power = 7, 50 mm aperture)

TABLE A-2. U.S. ARMY AIR-TO-GROUND LASER SYSTEMS

Device	Wavelength (nm)	ANSI Class	NOHD (km)	NOHD-0 (km)	OD	OD-0	Buffer Angle (mrad)	Beam Divergence (mrad)
TADS (AAH) (Apache)	1064	4	20	45	4.0	5.5	5	---
OH-58D	1064	4	35	56	4.1	5.3	5	---

Notes: NOHD-0 - NOHD with Optical Instruments (7 x 50)
 OD-0 - OD needed for Optical Instruments (7 x 50)
 (7 x 50: magnifying power = 7, 50 mm aperture)

TABLE A-3. USN & USMC AIR-TO-GROUND LASER SYSTEMS

Device	Wavelength (nm)	ANSI Class	NOHD (km)	NOHD-O (km)	OD	OD-O	Buffer Angle (mrad)
LAAT (AH1S) (MC)	1064	4	5	15	3.5	4.8	5
AN/AAS-33A (A6E TRAM)	1064	4	14.6	---	4.6	5.8	5
AN/AAS-37 (OV-10D NOS)	1064	4	11.2	45	5.2	5.6	5
AN/AAS-38A (F18)	1064	4	17	50	4.3	5.4	5
Nite Eagle (MC-Cobra) UH-1N	1064	4	15	45	4.1	5.2	5
AIM-1/MLR	800	3b	.085	.68	1.7	1.7	10
AIM-1/EXL	850	3b	.085	.68	1.7	1.7	10

Notes: NOHD-O - NOHD with Optical Instruments (7 x 50)
 OD-O - OD needed for Optical Instruments (7 x 50)
 (7 x 50: magnifying power = 7, 50 mm aperture)

TABLE A-4. GROUND-TO-GROUND LASER SYSTEMS

(Tank Mounted)

Device	ANSI Class	NOHD (km)	NOHD-0 (km)	t (m)	s (m)	Buffer Angle (mrad)
AN/VVG-1	4	10	80	10	60	Static Moving
AN/VVS-1	4	10	80	10	100	Not Permitted
AN/VVG-2 red filter (29db) green filter (55db)	4	10 .300 0	80 3.1 0	10 0 0	60 Target 0	2 2 N/A
AN/VVG-3	4	7	35	0	60	2 5 N/A

Notes: NOHD - Multiple pulse NOHD

NOHD-0 - NOHD with Optical Instruments (7 x 50)

t - diffuse reflection hazard distance

s - a predetermined (by the using service) distance around the target which must be cleared of specular reflective surfaces.

TABLE A-5. GROUND-TO-GROUND LASER SYSTEMS
(Tank Mounted)

Device	Wavelength (nm)	Built-in OD	Required OD
AN/VVG-1	694.3	Clip-on > 5	5.8
AN/VVS-1	694.3	Clip-on > 5	5.8
AN/VVG-2	694.3	Clip-on > 5	5.8
AN/VVG-3	1064	> 5	4.7

TABLE A-6. GROUND-TO-GROUND LASER SYSTEMS
(Man Portable)

Device	ANSI Class	NOHD (km)	NOHD-0 (km)	t (m)	s (m)	Buffer Angle (mrad)	
						Static	Moving
AN/GVT-1	1	0	0	0	0	N/A	N/A
LLTD	---	7	---	0	200	10	N/A
AN/GVS-5 (handheld) red filter (19db) yellow filter (29db)	4	2.7	20.6	0	200	10	N/A
		.29	1.8	0	200	10	N/A
		.056	.55	0	200	10	N/A
AN/PAQ-1 (handheld) target designator	4	7.7	33	0	200	10	N/A
CLD	---	9.7	---	0	200	10	N/A
AN/TVQ-2 Rangefinder w/ yellow filter (8.5db) Designator	4	8	40	0	60	2 on tripod	N/A
		2.5	23	0	100	5 on vehicle	N/A
		25	80	0	60 100	2 on tripod 5 on vehicle	N/A N/A

TABLE A-6 (continued)

Device	ANSI Class	NOHD (km)	NOHD-0 (km)	t (m)	s (m)	Buffer Angle (mrad)	
AN/PAQ-3 (mule) Rangefinder	4	6.5	35	0	60	Static	Moving
					200	2 on tripod 10 on vehicle	N/A N/A
Designator	4	20	79	0	60	Static	Moving
					200	2 on tripod 10 on vehicle	N/A N/A
AN/GAQ-TI	---	12.5	---	0	200	5	N/A
AN/PVS-X Rangefinder	---	3 single pulse	16	0	200	90	degrees
TD-100	---	0.1	---	0	30	10	10
LPL-30	---	.095	.68	0	20	10	10

Notes: NOHD- Multiple pulse NOHD

NOHD-0 - NOHD with Optical Instruments (7 x 50)

t - diffuse reflection hazard distance

s - a predetermined (by the using service) distance around the target which must be cleared of specular reflective surfaces.

TABLE A-7. GROUND-TO-GROUND LASER SYSTEMS

(Man Portable)

Device	Wavelength (nm)	Built-in OD	Required OD
AN/GVT-1	1064	N/A	0
AN/GVS-5	1064	5	3.7
AN/PAQ-1	1064	4	4.2
AN/TVQ-2	1064	yes	3.8
AN/PAQ-3	1064	> 5	3.9
AN/GAQ-T1	1064	yes	4.6
LLTD	1064	---	4.0
CLD	1064	5	4.5
LPL-30	800-850	1.7	1.7

Notes: The built-in OD only protects against the wavelength of the laser in which it is installed.

APPENDIX B

Description and Hazard Evaluation of the Laser Systems

Description of Fielded Laser Systems

- a. AN/VVS-1: Laser Range Finder mounted on the M60A2 tank.
- b. AN/VVG-1: Laser Range Finder mounted on the M551A1 Sheridan Vehicles.
- c. AN/VVG-2: Laser Range Finder mounted on the M60A3 tank. Used with two filters, the green Eye Safe Simulated Laser Range Finder (ESSLR) filter and the red ESSLR filter. The green ESSLR is eye safe, the red ESSLR is less hazardous than the system without filters.
- d. AN/VVG-3: M1 tank laser rangefinder used with one eye safe filter.
- e. AN/GVS-5: Laser Range Finder Infrared Observation Set (Handheld).
- f. AN/PAQ-1: (LTD) Laser Target Designator. This is a lightweight, handheld, battery operated laser device. Forward observers use it to designate targets.
- g. AN/TVQ-2: (G/VLLD) Ground/Vehicle Laser Locator Designator. This is a ranging and laser designating device used by Army artillery forward observers with laser energy homing munitions. It is capable of designating stationary or moving vehicular targets and may be used in a stationary, vehicle mounted, or tripod supported dismounted mode. The primary vehicle mount is the Fire Support Team Vehicle (FISTV).
- h. AN/PAQ-3: (MULE) Modular Universal Laser Equipment. This is a Marine Corps laser designator used with laser energy homing munitions. The MULE is man portable and is used only in a dismounted mode.
- i. Laser Augmented Airborne TOW (LAAT) mounted in the AH-1S COBRA Helicopter. The LAAT system consists of a laser range finder and receiver that is incorporated into the M65 tube launched, optically tracked, wire guided (TOW) telescopic sight unit.
- j. Target Acquisition and Designation System with Pilot Night Vision Sight (TADS/PNVS) mounted in the Apache Advanced Attack Helicopter.
- k. Mast Mounted Sight on the OH-58D that, in addition to thermal and optical sensors and imaging instrumentation, incorporates a laser rangefinder and/or designator.
- l. AN/AAS-37: Laser Range Finder Designator mounted on the Marine Corps OV-10 Observation Aircraft.

m. AN/AAS-33A: Target Recognition Attach Multisensor (TRAM) laser system. This system is mounted on the A6-E Aircraft and has a laser target designator and forward looking infrared (FLIR).

n. LANTIRN System: Low Altitude Navigation and Targeting Infrared System for Night. A two pod system containing a terrain following radar (TFR), forward looking infrared (FLIR), laser designation, and later, a target recognition system. This system is designed to be flown on the F-15, F-16, and A-10. The laser operates at 1064 nm and has a training modification to operate at 1540 nm which is "eye safe".

o. PAVE SPECTRE (AN/AVQ-19): Laser tracking and designator used on C-130 gunships.

p. PAVE SPIKE (AN/AVQ-12): Laser tracking and designator pod fitted on F-4 and F-111 aircraft.

q. PAVE TACK (AN/AVQ-26): Advanced optronics pod containing stabilized turret with FLIR, laser designator and tracker used on the F-4, RF-4, and F-111F aircraft.

r. COMPACT LASER DESIGNATOR (CLD): A small, lightweight laser designator and/or rangefinder used by the Navy for target designation.

s. TD-100: A day/night aiming laser. For daytime use this device uses a class 2 helium neon visible laser and for night time it uses a class 3b infrared laser diode. Night vision goggles will provide adequate night time protection for any one viewing the infrared laser.

t. AIM-1: A class 3b infrared diode aiming laser for use with night vision goggles. The AIM/MIR is mounted on USAF and Marine Corps 50 caliber helicopter gun mounts. The AIM/EXL version is hard mounted on the AH-1 turret. Night vision goggles provide adequate protection against these lasers.

u. LPL-30: A class 3b infrared diode aiming laser used by command to indicate targets of choice to attacking forces equipped with the night vision goggles. Night vision goggles also provide adequate protection against these lasers.

LASER HAZARD EVALUATION

lantirn 1064nm

A. A hazard evaluation was accomplished for a laser with the following operational characteristics:

Wavelength	1064.00	nm
Energy/pulse	1.70E-01	Joules/pulse
Pulse width	15.00	nsec
Pulse rep freq	2.00E+01	Hz
Beam diameter	3.38	cm at 1/e point
Divergence	0.18	mradians at 1/e point

B. This is an ANSI Class 4 Laser and should be operated in accordance with the safety measures outlined in AFOSH STD 161-10 along with such other safety procedures required by the responsible safety officer.

C. The Maximum Permissible Exposure (MPE) limits are listed below. The MPE is defined as the radiant exposure which personnel may receive without adverse biological effects.

Single Pulse MPEs

Type of MPE	Exposure Duration (s)	MPE
Ocular point source	1.50E-08	5.00E-06 J/cm2
Ocular extended source	1.50E-08	1.23E-01 J/cm2/sr
Skin	1.50E-08	1.00E-01 J/cm2

Multiple Pulse MPEs

Type of MPE	Exposure Duration (s)	MPE/pulse
Ocular point source	2.50E-01	3.34E-06 J/cm2
Ocular point source	1.00E+01	1.33E-06 J/cm2
Ocular point source	3.00E+04	1.80E-07 J/cm2
Ocular extended source	2.50E-01	6.30E+00 J/cm2/sr
Ocular extended source	1.00E+01	5.38E-01 J/cm2/sr
Ocular extended source	3.00E+04	1.60E-01 J/cm2/sr
Skin	2.50E-01	1.00E-01 J/cm2
Skin	1.00E+01	4.89E-02 J/cm2
Skin	3.00E+04	5.00E-02 J/cm2

D. The Nominal Ocular Hazard Distance (NOHD) for various exposure conditions is listed below. The NOHD is defined as the distance from the laser where the radiant exposure is equal to the MPE.

NOHD

Type of NOHD	Exposure Duration (s)	(m)	(ft)
Ocular point	1.50E-08	1.16E+04	3.82E+04

Ocular point	2.50E-01	1.43E+04	4.68E+04
Ocular point	1.00E+01	2.27E+04	7.46E+04
Ocular point	3.00E+04	6.22E+04	2.04E+05
Diffuse reflection	1.50E-08	0.00E+00	0.00E+00
Diffuse reflection	2.50E-01	0.00E+00	0.00E+00
Diffuse reflection	1.00E+01	0.00E+00	0.00E+00
Diffuse reflection	3.00E+04	0.00E+00	0.00E+00
Skin	1.50E-08	0.00E+00	0.00E+00
Skin	2.50E-01	0.00E+00	0.00E+00
Skin	1.00E+01	0.00E+00	0.00E+00
Skin	3.00E+04	0.00E+00	0.00E+00

E. The optical density (OD) is a measure of the opacity to radiation expressed in logarithmic units. The following are OD values required at the distances listed.

OD Required at the Laser Aperture

Wavelength(nm)	Exposure Time (s)	Ocular OD	Skin OD
1064.0	1.50E-08	3.58	0.00
1064.0	2.50E-01	3.75	0.00
1064.0	1.00E+01	4.15	0.00
1064.0	3.00E+04	5.02	0.00

OD Required at 100 meters from the Laser

Wavelength(nm)	Exposure Time (s)	Ocular OD	Skin OD
1064.0	1.50E-08	3.21	0.00
1064.0	2.50E-01	3.39	0.00
1064.0	1.00E+01	3.79	0.00
1064.0	3.00E+04	4.66	0.00

LASER HAZARD EVALUATION

3/4/92

lantirn 1540 nm

A. A hazard evaluation was accomplished for a laser with the following operational characteristics:

Wavelength	1540.00	nm
Energy/pulse	2.20E-02	Joules/pulse
Pulse width	17.00	nsec
Pulse rep freq	1.00E+00	Hz
Beam diameter	3.38	cm at 1/e point
Divergence	0.18	mradians at 1/e point

B. This is an ANSI Class 3b Laser and should be operated in accordance with the safety measures outlined in AFOSH STD 161-10 along with such other safety procedures required by the responsible safety officer.

C. The Maximum Permissible Exposure (MPE) limits are listed below. The MPE is defined as the radiant exposure which personnel may receive without adverse biological effects.

Single Pulse MPEs

Type of MPE	Exposure Duration (s)	MPE
Ocular or Skin	1.70E-08	1.00E+00 J/cm2

Multiple Pulse MPEs

Type of MPE	Exposure Duration (s)	MPE/pulse
Ocular or Skin	2.50E-01	1.41E+00 J/cm2
Ocular or Skin	1.00E+01	5.62E-01 J/cm2
Ocular or Skin	3.00E+04	7.60E-02 J/cm2

D. The Nominal Ocular Hazard Distance (NOHD) for various exposure conditions is listed below. The NOHD is defined as the distance from the laser where the radiant exposure is equal to the MPE.

NOHD

Type of NOHD	Exposure Duration (s)	(m)	(ft)
Ocular or Skin	1.70E-08	0.00E+00	0.00E+00
Ocular or Skin	2.50E-01	0.00E+00	0.00E+00
Ocular or Skin	1.00E+01	0.00E+00	0.00E+00
Ocular or Skin	3.00E+04	0.00E+00	0.00E+00
Diffuse reflection	1.70E-08	0.00E+00	0.00E+00
Diffuse reflection	2.50E-01	0.00E+00	0.00E+00
Diffuse reflection	1.00E+01	0.00E+00	0.00E+00
Diffuse reflection	3.00E+04	0.00E+00	0.00E+00

E. The optical density (OD) is a measure of the opacity to radiation expressed in logarithmic units. The following are OD values required at the distances listed.

OD Required at the Laser Aperture

Wavelength(nm)	Exposure Time (s)	Ocular OD	Skin OD
1540.0	1.70E-08	0.00	0.00
1540.0	2.50E-01	0.00	0.00
1540.0	1.00E+01	0.00	0.00
1540.0	3.00E+04	0.00	0.00

OD Required at 100 meters from the Laser

Wavelength(nm)	Exposure Time (s)	Ocular OD	Skin OD
1540.0	1.70E-08	0.00	0.00
1540.0	2.50E-01	0.00	0.00
1540.0	1.00E+01	0.00	0.00
1540.0	3.00E+04	0.00	0.00

The 1540 nm training mode is also "eye safe" when using optics of up to (20X) magnification.

LASER HAZARD EVALUATION

Pave Spectre AN/AVQ-19

A. A hazard evaluation was accomplished for a laser with the following operational characteristics:

Wavelength	1064.00	nm
Energy/pulse	1.10E-01	Joules/pulse
Pulse width	18.00	nsec
Pulse rep freq	1.00E+01	Hz
Beam diameter	4.18	cm at 1/e point
Divergence	0.33	mradians at 1/e point

B. This is an ANSI Class 4 Laser and should be operated in accordance with the safety measures outlined in AFOSH STD 161-10 along with such other safety procedures required by the responsible safety officer.

C. The Maximum Permissible Exposure (MPE) limits are listed below. The MPE is defined as the radiant exposure which personnel may receive without adverse biological effects.

Single Pulse MPEs

Type of MPE	Exposure Duration (s)	MPE
Ocular point source	1.80E-08	5.00E-06 J/cm ²
Ocular extended source	1.80E-08	1.31E-01 J/cm ² /sr
Skin	1.80E-08	1.00E-01 J/cm ²

Multiple Pulse MPEs

Type of MPE	Exposure Duration (s)	MPE/pulse
Ocular point source	2.50E-01	3.98E-06 J/cm ²
Ocular point source	1.00E+01	1.58E-06 J/cm ²
Ocular point source	3.00E+04	2.14E-07 J/cm ²
Ocular extended source	2.50E-01	1.26E+01 J/cm ² /sr
Ocular extended source	1.00E+01	1.08E+00 J/cm ² /sr
Ocular extended source	3.00E+04	3.20E-01 J/cm ² /sr
Skin	2.50E-01	1.00E-01 J/cm ²
Skin	1.00E+01	9.78E-02 J/cm ²
Skin	3.00E+04	1.00E-01 J/cm ²

D. The Nominal Ocular Hazard Distance (NOHD) for various exposure conditions is listed below. The NOHD is defined as the distance from the laser where the radiant exposure is equal to the MPE.

Type of NOHD	NOHD		
	Exposure Duration (s)	(m)	(ft)
Ocular point	1.80E-08	4.95E+03	1.62E+04
Ocular point	2.50E-01	5.56E+03	1.82E+04
Ocular point	1.00E+01	8.89E+03	2.92E+04
Ocular point	3.00E+04	2.44E+04	8.01E+04
Diffuse reflection	1.80E-08	0.00E+00	0.00E+00
Diffuse reflection	2.50E-01	0.00E+00	0.00E+00
Diffuse reflection	1.00E+01	0.00E+00	0.00E+00
Diffuse reflection	3.00E+04	0.00E+00	0.00E+00
Skin	1.80E-08	0.00E+00	0.00E+00
Skin	2.50E-01	0.00E+00	0.00E+00
Skin	1.00E+01	0.00E+00	0.00E+00
Skin	3.00E+04	0.00E+00	0.00E+00

E. The optical density (OD) is a measure of the opacity to radiation expressed in logarithmic units. The following are OD values required at the distances listed.

OD Required at the Laser Aperture			
Wavelength(nm)	Exposure Time (s)	Ocular OD	Skin OD
1064.0	1.80E-08	3.20	0.00
1064.0	2.50E-01	3.30	0.00
1064.0	1.00E+01	3.70	0.00
1064.0	3.00E+04	4.57	0.00

LASER HAZARD EVALUATION

LHAZ ver 2.0

PAVE SPIKE

A. A hazard evaluation was accomplished for a laser with the following operational characteristics:

Wavelength = 1064.0 nanometers

Multiple Pulse Laser

Energy = 1.68E-01 Joules/Pulse

Pulse Width = 1.50E-08 sec

PRF = 1.00E+01 Hertz

Beam diameter = 3.59E+00 cm at 1/e point

Divergence = 3.50E-04 radians at 1/e point

B. This is an ANSI Class 4 Laser and should be operated in accordance with the safety measures outlined in AFOSH STD 161-10 along with such other safety procedures required by the responsible safety officer.

C. The Maximum Permissible Exposure (MPE) limits are listed below. The MPE is defined as the radiant exposure which personnel may receive without biological effects.

Type of MPE	Exposure Duration (s)	MPE
Ocular point source	Single Pulse	5.00E-06 J/cm ²
Ocular point source	0.25	9.94E-06 J/cm ²
Ocular point source	10.0	1.58E-04 J/cm ²
Ocular point source	30,000	6.41E-02 J/cm ²
Ocular point source	1.000	2.81E-05J/cm ²
Ocular extended source	Single Pulse	1.23E-01 J/cm ² /sr
Ocular extended source	0.25	3.08E-01 J/cm ² /sr
Ocular extended source	10.0	1.23E+01 J/cm ² /sr
Ocular extended source	30,000	9.60E+04 J/cm ² /sr
Ocular extended source	1.000	1.23E+00J/cm ² /sr
Skin	Single Pulse	1.00E-01 J/cm ²
Skin	0.25	2.50E-01 J/cm ²
Skin	10.0	1.00E+01 J/cm ²
Skin	30,000	3.00E+04 J/cm ²
Skin	1.000	1.00E+00J/cm ²

D. The Safe Exposure Distance (SED)/(NOHD) for various exposure conditions is listed below The SED is defined as the distance from an operating laser at which the radiant exposure is equal to the MPE.

SED/NOHD		
Type of SED/NOHD	Exposure Duration (s)	(m)
Ocular point	Single Pulse	5.81E+03
Ocular point	0.25	6.52E+03
Ocular point	10.0	1.04E+04
Ocular point	30,000	2.85E+04
Ocular point	1.000	7.78E+03
Diffuse reflection	Single Pulse	0.00E+00
Diffuse reflection	0.25	0.00E+00
Diffuse reflection	10.0	0.00E+00
Diffuse reflection	30,000	0.00E+00
Diffuse reflection	1.000	0.00E+00
Skin	Single Pulse	0.00E+00
Skin	0.25	0.00E+00
Skin	10.0	0.00E+00
Skin	30,000	0.00E+00
Skin	1.000	0.00E+00

E. The optical density (OD) is a measure of the opacity to radiation expressed in logarithmic units. The following are OD values required at the distances listed.

OD Required at the Laser Aperture

Wavelength(nm)	Exposure Time (s)	Ocular OD	Skin OD
1064.0	Single Pulse	3.52	0.00
1064.0	0.25	3.62	0.00
1064.0	10.0	4.02	0.00
1064.0	30,000	4.89	0.00
1064.0	1.000	3.77	0.00

OD Required at 1.0 km

Wavelength(nm)	Exposure Time (s)	Ocular OD	Skin OD
1064.0	Single Pulse	1.46	0.00
1064.0	0.25	1.56	0.00
1064.0	10.0	1.96	0.00
1064.0	30,000	2.83	0.00
1064.0	1.000	1.71	0.00

OD Required at 5.0 km

Wavelength(nm)	Exposure Time (s)	Ocular OD	Skin OD
1064.0	Single Pulse	0.13	0.00
1064.0	0.25	0.23	0.00
1064.0	10.0	0.63	0.00
1064.0	30,000	1.50	0.00

LASER HAZARD EVALUATION

LHAZ ver 2.0

PAVE TACK

A. A hazard evaluation was accomplished for a laser with the following operational characteristics:

Wavelength = 1064.0 nanometers

Multiple Pulse Laser

Energy = 1.80E-01 Joules/Pulse

Pulse Width = 2.50E-08 sec

PRF = 2.00E+01 Hertz

Beam diameter = 4.50E-01 cm at 1/e point

Divergence = 1.80E-03 radians at 1/e point

B. This is an ANSI Class 4 Laser and should be operated in accordance with the safety measures outlined in AFOSH STD 161-10 along with such other safety procedures required by the responsible safety officer.

C. The Maximum Permissible Exposure (MPE) limits are listed below. The MPE is defined as the radiant exposure which personnel may receive without biological effects.

Type of MPE	Exposure Duration (s)	MPE
Ocular point source	Single Pulse	5.00E-06 J/cm ²
Ocular point source	0.25	1.67E-05 J/cm ²
Ocular point source	10.0	2.66E-04 J/cm ²
Ocular point source	30,000	1.08E-01 J/cm ²
Ocular point source	1.000	4.73E-05J/cm ²
Ocular extended source	Single Pulse	1.46E-01 J/cm ² /sr
Ocular extended source	0.25	7.31E-01 J/cm ² /sr
Ocular extended source	10.0	2.92E+01 J/cm ² /sr
Ocular extended source	30,000	9.60E+04 J/cm ² /sr
Ocular extended source	1.000	2.92E+00J/cm ² /sr
Skin	Single Pulse	1.00E-01 J/cm ²
Skin	0.25	5.00E-01 J/cm ²
Skin	10.0	1.00E+01 J/cm ²
Skin	30,000	3.00E+04 J/cm ²
Skin	1.000	2.00E+00J/cm ²

D. The Safe Exposure Distance (SED)/(NOHD) for various exposure conditions is listed below The SED is defined as the distance from an operating laser at which the radiant exposure is equal to the MPE.

SED/NOHD		
Type of SED/NOHD	Exposure Duration (s)	(m)
Ocular point	Single Pulse	1.19E+03
Ocular point	0.25	1.45E+03
Ocular point	10.0	2.30E+03
Ocular point	30,000	6.27E+03
Ocular point	1.000	1.73E+03
Diffuse reflection	Single Pulse	1.07E+00
Diffuse reflection	0.25	1.31E+00
Diffuse reflection	10.0	2.08E+00
Diffuse reflection	30,000	5.65E+00
Diffuse reflection	1.000	1.56E+00
Skin	Single Pulse	5.91E+00
Skin	0.25	5.91E+00
Skin	10.0	9.39E+00
Skin	30,000	9.39E+00
Skin	1.000	5.91E+00

E. The optical density (OD) is a measure of the opacity to radiation expressed in logarithmic units. The following are OD values required at the distances listed.

OD Required at the Laser Aperture

Wavelength (nm)	Exposure Time (s)	Ocular OD	Skin OD
1064.0	Single Pulse	4.97	1.05
1064.0	0.25	5.15	1.05
1064.0	10.0	5.55	1.35
1064.0	30,000	6.42	1.35
1064.0	1.000	5.30	1.05

OD Required at 1.0 km

Wavelength (nm)	Exposure Time (s)	Ocular OD	Skin OD
1064.0	Single Pulse	0.15	0.00
1064.0	0.25	0.32	0.00
1064.0	10.0	0.72	0.00
1064.0	30,000	1.59	0.00
1064.0	1.000	0.47	0.00

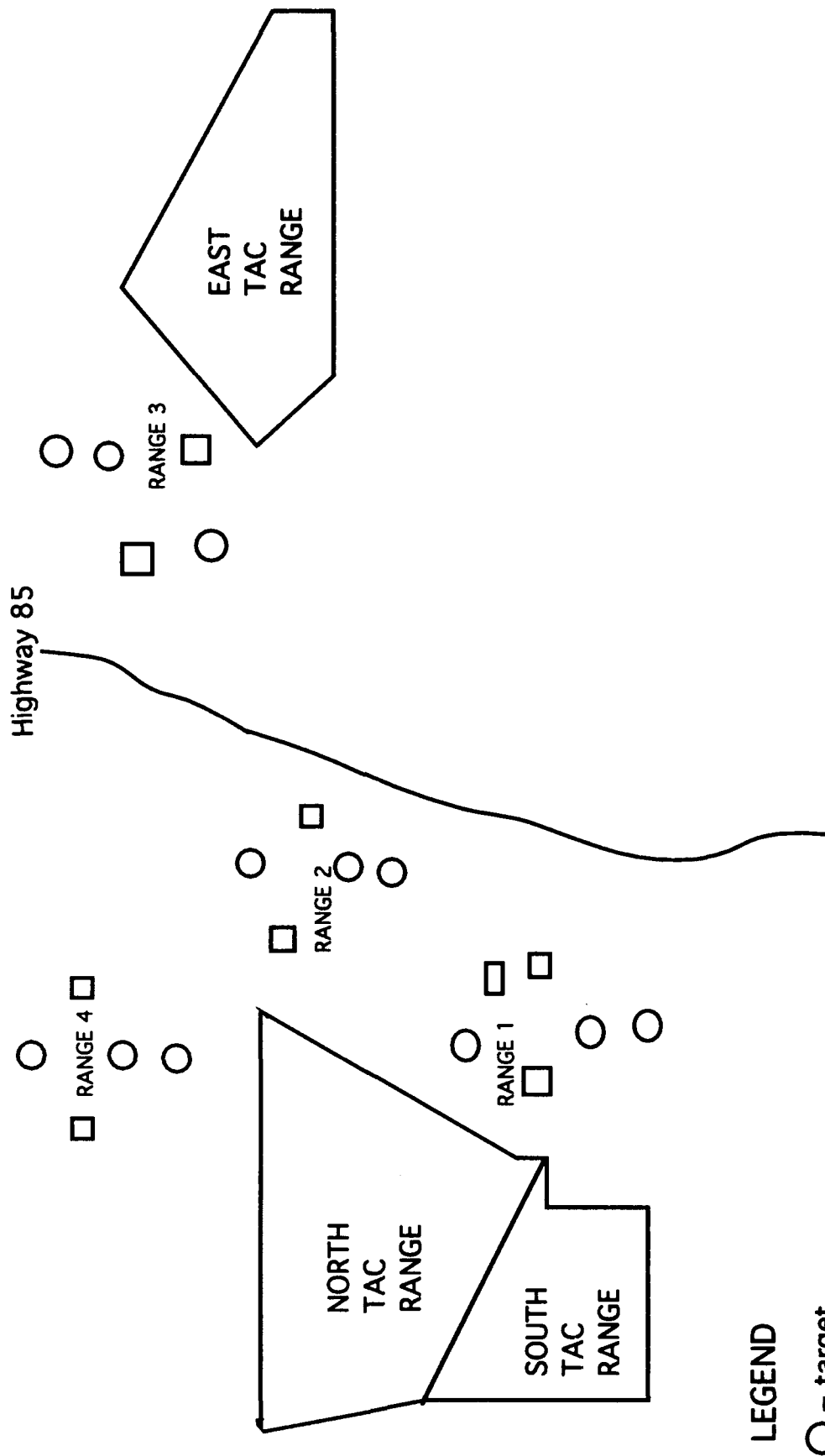
OD Required at 5.0 km

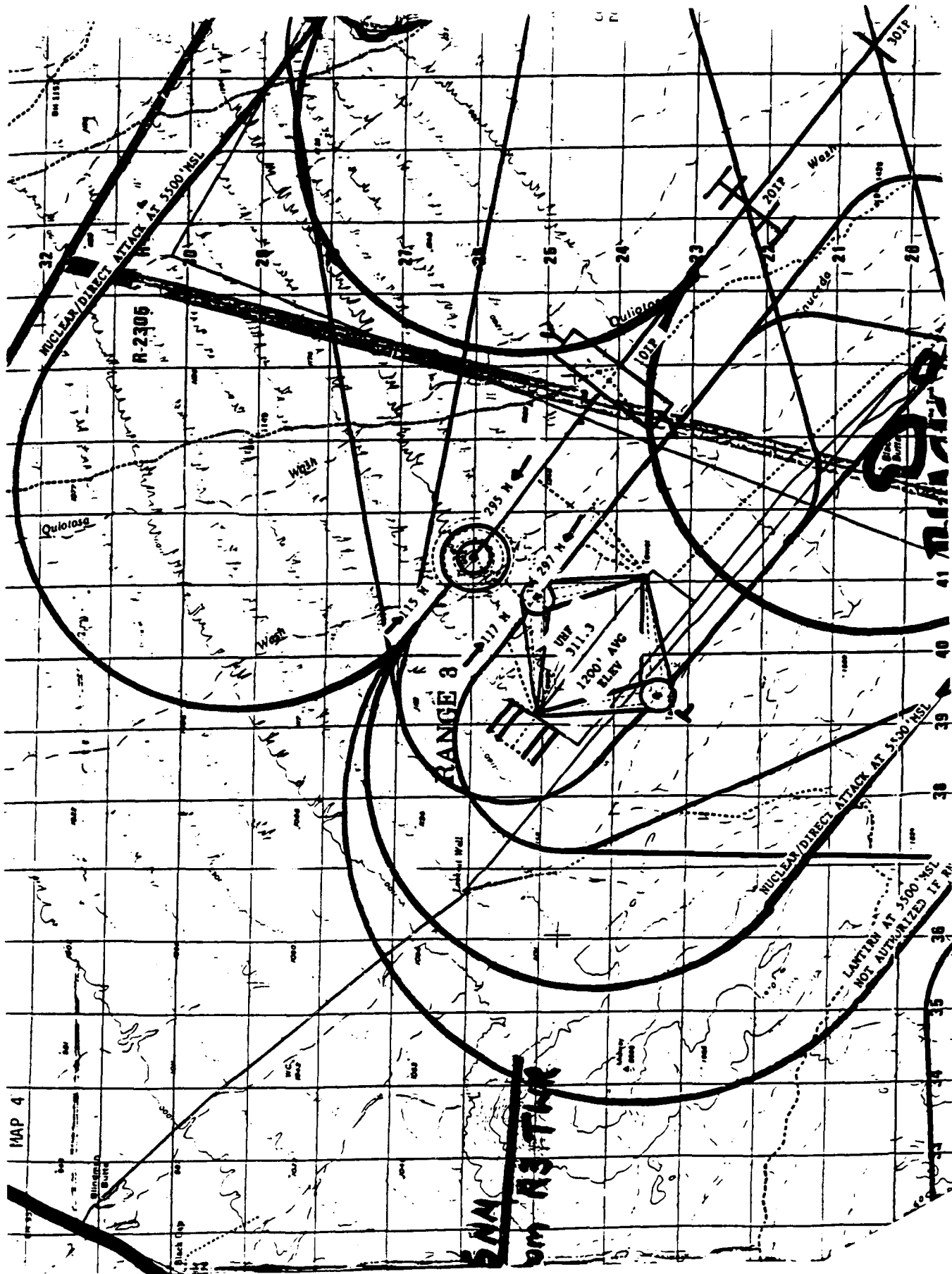
Wavelength (nm)	Exposure Time (s)	Ocular OD	Skin OD
1064.0	Single Pulse	0.00	0.00
1064.0	0.25	0.00	0.00
1064.0	10.0	0.00	0.00
1064.0	30,000	0.20	0.00

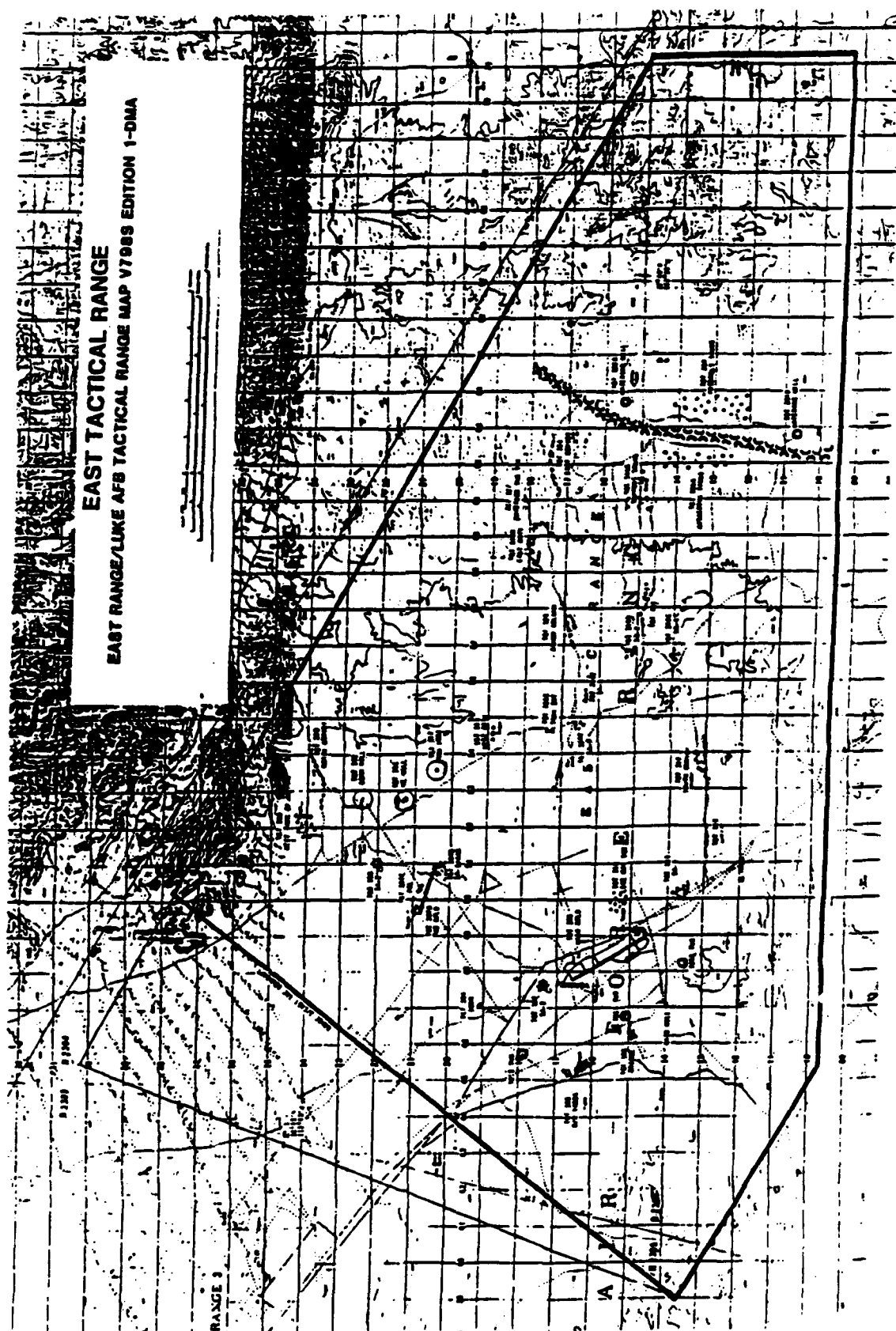
APPENDIX C

Range Maps

MAP 1
Luke Air Force Base Range

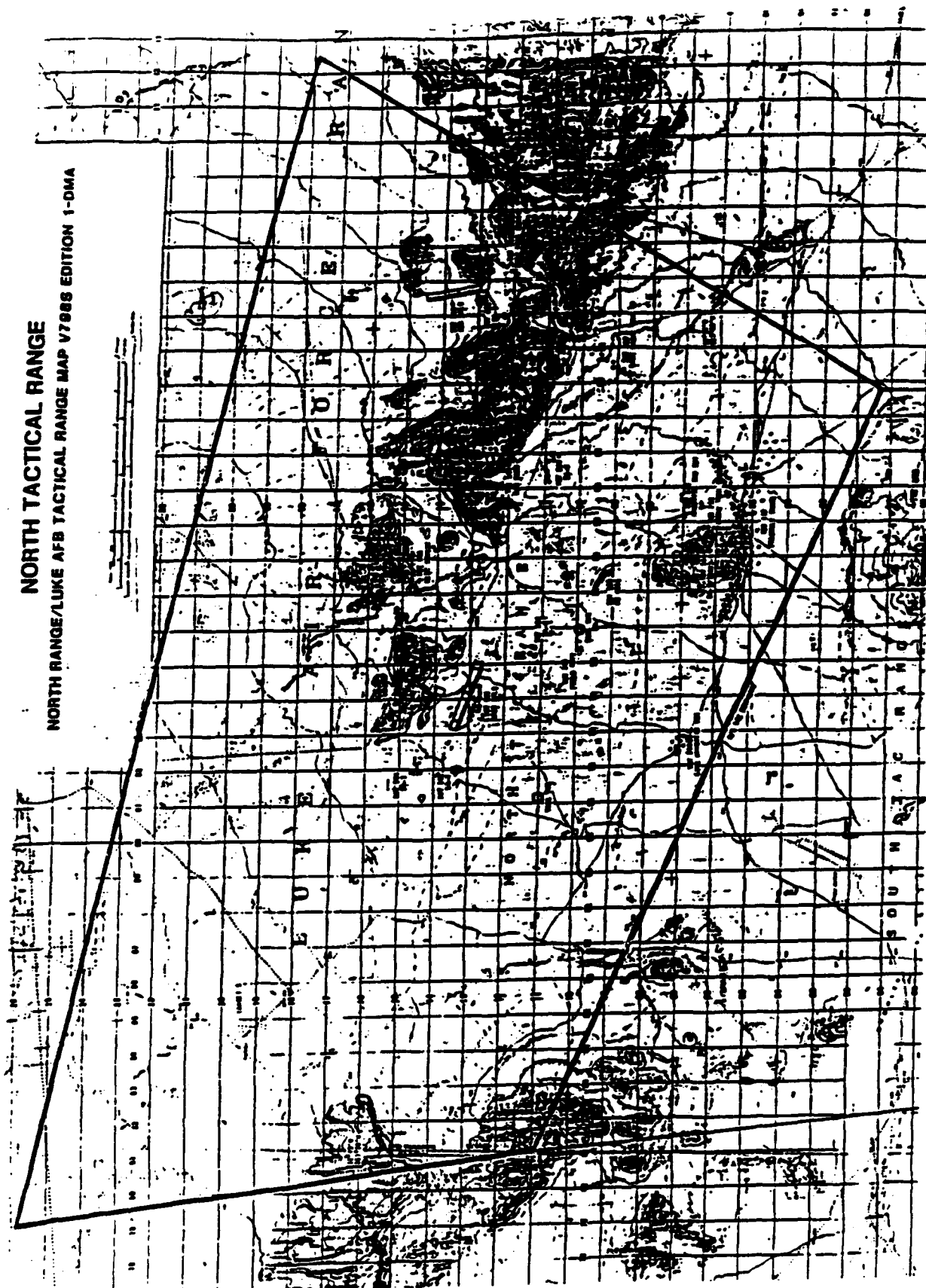






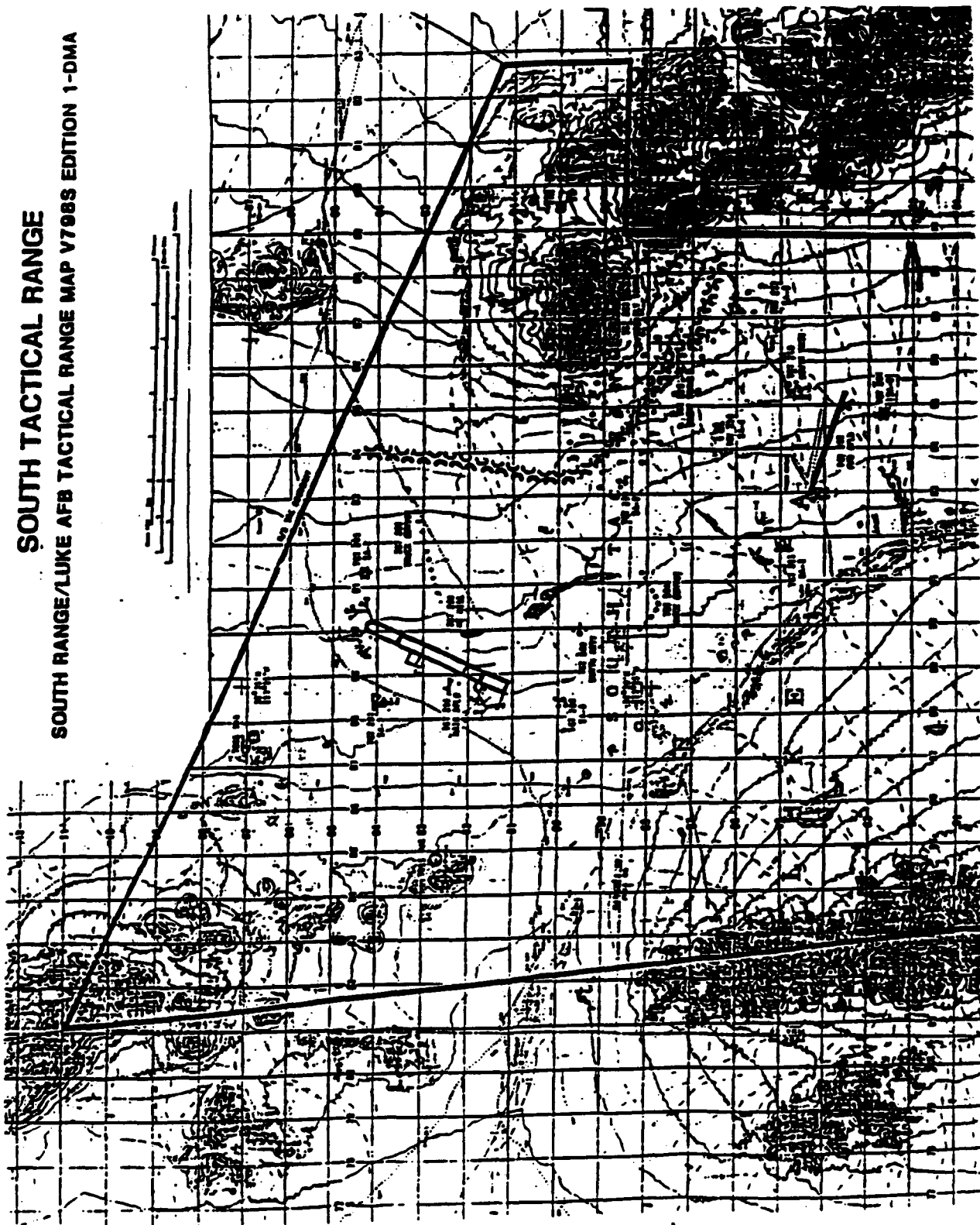
NORTH TACTICAL RANGE

NORTH RANGE/LUKE AFB TACTICAL RANGE MAP V7988 EDITION 1-DMA



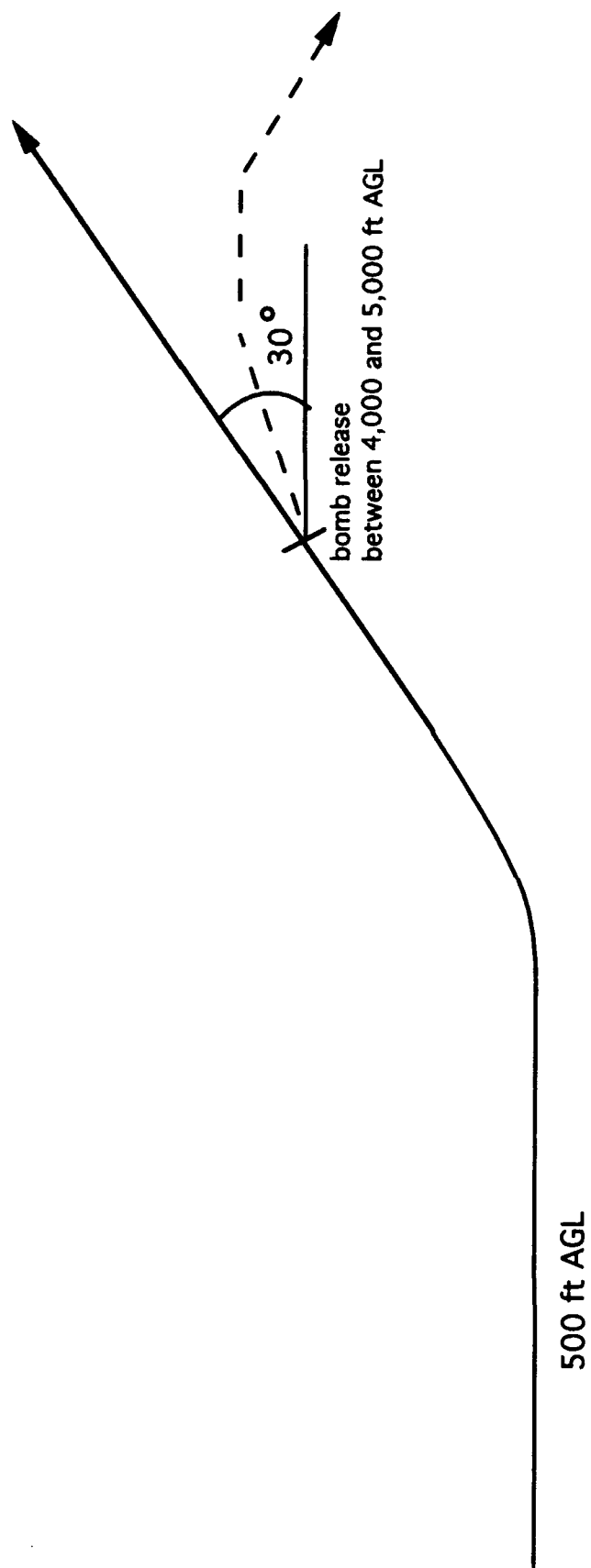
SOUTH TACTICAL RANGE

SOUTH RANGE/LUKE AFB TACTICAL RANGE MAP V798S EDITION 1-DMA



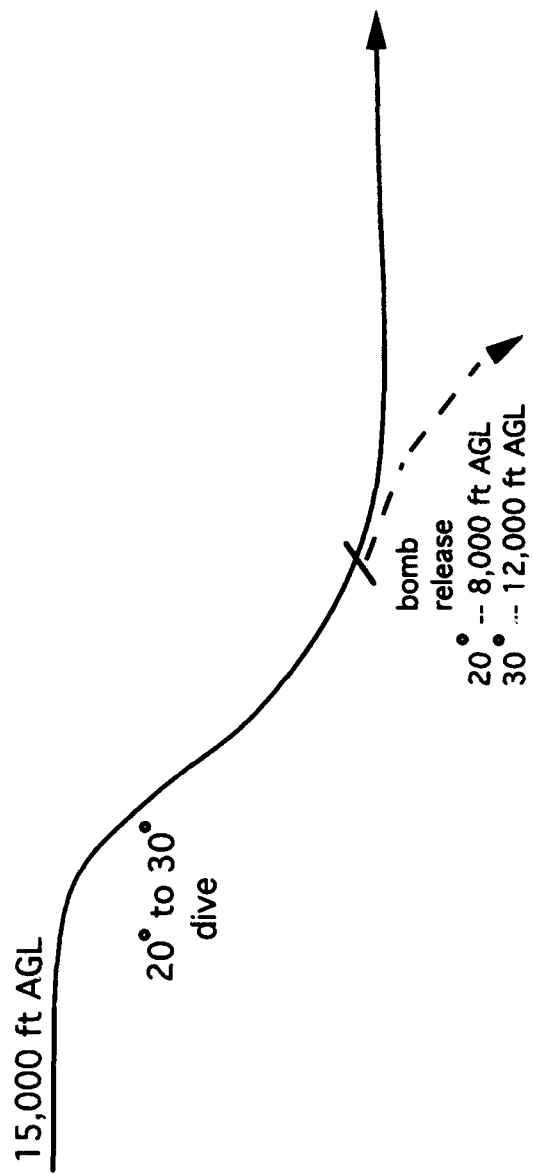
APPENDIX D
DELIVERY PROFILES

LOFT DELIVERY PROFILE



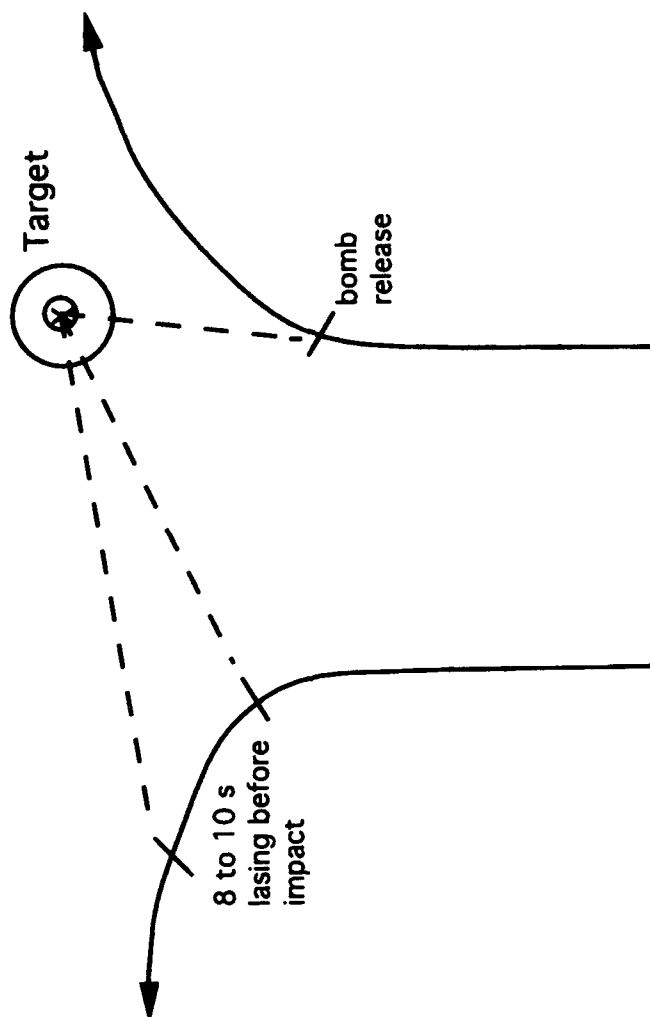
(Side View)

MEDIUM ALTITUDE PROFILE



(Side View)

"BUDDY LASE" PROFILE



(Top View)

APPENDIX E
Footprint Calculations

Loft Delivery

LASER FOOTPRINT TABLE for: LANTIRN

Table based on: Flat terrain, Buffer= 2 mrad, Divergence= .18 mrad
 NOHD= 22700 meters (74456 feet or 12.3 nautical miles)

Table values are FOOTPRINT dimensions(feet and meters)

ALTITUDE (feet)	FOOTPRINT	SLANT RANGE (nautical miles, feet, and meters)							
		2.0 NM	2.5 NM	3.0 NM	3.5 NM	4.0 NM	4.5 NM		
500		12200 ft	15200 ft	18200 ft	21300 ft	24300 ft	27300 ft		
		3700 m	4630 m	5560 m	6480 m	7410 m	8330 m		
	FORWARD	650 ft	1030 ft	1500 ft	2070 ft	2750 ft	3530 ft		
1000		198 m	314 m	458 m	632 m	838 m	1080 m		
		587 ft	907 ft	1290 ft	1740 ft	2240 ft	2800 ft		
	AFT	179 m	276 m	393 m	529 m	683 m	855 m		
1500	FORWARD	317 ft	498 ft	722 ft	989 ft	1300 ft	1660 ft		
		97 m	152 m	220 m	301 m	396 m	505 m		
	AFT	301 ft	467 ft	669 ft	905 ft	1170 ft	1480 ft		
2000		92 m	142 m	204 m	276 m	358 m	451 m		
	FORWARD	209 ft	328 ft	475 ft	649 ft	852 ft	1080 ft		
		64 m	100 m	145 m	198 m	260 m	330 m		
2500		202 ft	315 ft	452 ft	612 ft	796 ft	1000 ft		
	AFT	62 m	96 m	138 m	187 m	243 m	306 m		
	FORWARD	156 ft	245 ft	354 ft	483 ft	633 ft	804 ft		
3000		48 m	75 m	108 m	147 m	193 m	245 m		
	AFT	152 ft	237 ft	341 ft	462 ft	602 ft	760 ft		
		46 m	72 m	104 m	141 m	184 m	232 m		
3500	FORWARD	125 ft	195 ft	282 ft	385 ft	504 ft	640 ft		
		38 m	60 m	86 m	117 m	154 m	195 m		
	AFT	122 ft	191 ft	274 ft	372 ft	484 ft	611 ft		
4000		37 m	58 m	83 m	113 m	148 m	186 m		
	FORWARD	104 ft	162 ft	234 ft	320 ft	419 ft	531 ft		
		32 m	50 m	71 m	97 m	128 m	162 m		
4500		102 ft	159 ft	229 ft	311 ft	405 ft	511 ft		
	AFT	31 m	48 m	70 m	95 m	123 m	156 m		
	FORWARD	89 ft	139 ft	201 ft	273 ft	358 ft	454 ft		
5000		27 m	42 m	61 m	83 m	109 m	138 m		

FP2.TXT

4000	AFT	88 ft 27 m	137 ft 42 m	196 ft 60 m	267 ft 81 m	348 ft 106 m	439 ft 134 m
	FORWARD	78 ft 24 m	121 ft 37 m	175 ft 53 m	239 ft 73 m	313 ft 95 m	396 ft 121 m
	AFT	77 ft 23 m	120 ft 36 m	172 ft 52 m	234 ft 71 m	305 ft 93 m	385 ft 117 m
4500	FORWARD	69 ft 21 m	108 ft 33 m	156 ft 47 m	212 ft 65 m	277 ft 85 m	352 ft 107 m
	AFT	68 ft 21 m	106 ft 32 m	153 ft 47 m	208 ft 63 m	271 ft 83 m	343 ft 105 m
5000	FORWARD	62 ft 19 m	97 ft 30 m	140 ft 43 m	191 ft 58 m	249 ft 76 m	316 ft 96 m
	AFT	61 ft 19 m	96 ft 29 m	138 ft 42 m	187 ft 57 m	244 ft 75 m	309 ft 94 m
	WIDTH	51 ft 15 m	63 ft 19 m	76 ft 23 m	89 ft 27 m	102 ft 31 m	114 ft 35 m

FOOTPRINT FORWARD- distance beyond target.

FOOTPRINT AFT- distance from target toward aircraft.

FOOTPRINT WIDTH- total width at target.

NOTE: -99 indicates an impossible alt./range combination

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LASER FOOTPRINT TABLE for: LANTIRN

Table based on: Flat terrain, Buffer= 2 mrad, Divergence= .18 mrad
 NOHD= 22700 meters (74456 feet or 12.3 nautical miles)

Table values are FOOTPRINT dimensions(feet and meters)

ALTITUDE (feet)	SLANT RANGE (nautical miles, feet, and meters)							
	FOOTPRINT	2.0 NM	2.5 NM	3.0 NM	3.5 NM	4.0 NM	4.5 NM	
5000		12200 ft	15200 ft	18200 ft	21300 ft	24300 ft	27300 ft	
		3700 m	4630 m	5560 m	6480 m	7410 m	8330 m	
	FORWARD	62 ft	97 ft	140 ft	191 ft	249 ft	316 ft	
	AFT	19 m	30 m	43 m	58 m	76 m	96 m	
5500		61 ft	96 ft	138 ft	187 ft	244 ft	309 ft	
		19 m	29 m	42 m	57 m	75 m	94 m	
	FORWARD	56 ft	88 ft	127 ft	173 ft	227 ft	287 ft	
	AFT	17 m	27 m	39 m	53 m	69 m	87 m	
6000		56 ft	87 ft	125 ft	171 ft	222 ft	281 ft	
		17 m	27 m	38 m	52 m	68 m	86 m	
	FORWARD	52 ft	81 ft	116 ft	159 ft	207 ft	263 ft	
	AFT	16 m	25 m	35 m	48 m	63 m	80 m	
		51 ft	80 ft	115 ft	156 ft	204 ft	258 ft	
		16 m	24 m	35 m	48 m	62 m	79 m	
	WIDTH	51 ft	63 ft	76 ft	89 ft	102 ft	114 ft	
		15 m	19 m	23 m	27 m	31 m	35 m	

FOOTPRINT FORWARD- distance beyond target.

FOOTPRINT AFT- distance from target toward aircraft.

FOOTPRINT WIDTH- total width at target.

NOTE: -99 indicates an impossible alt./range combination

@

LASER FOOTPRINT TABLE for: LANTIRN

Table based on: Flat terrain, Buffer= 2 mrad, Divergence= .18 mrad
 NOHD= 22700 meters (74456 feet or 12.3 nautical miles)

Table values are FOOTPRINT dimensions(feet and meters)

ALTITUDE (feet)	FOOTPRINT	SLANT RANGE (nautical miles, feet, and meters)	
		4.5 NM	5.0 NM
		27300 ft	30400 ft
		8330 m	9260 m
500	FORWARD	3530 ft	4420 ft
		1080 m	1350 m
	AFT	2800 ft	3420 ft
		855 m	1040 m
1000	FORWARD	1660 ft	2060 ft
		505 m	628 m
	AFT	1480 ft	1810 ft
		451 m	553 m
1500	FORWARD	1080 ft	1340 ft
		330 m	409 m
	AFT	1000 ft	1230 ft
		306 m	376 m
2000	FORWARD	804 ft	996 ft
		245 m	304 m
	AFT	760 ft	935 ft
		232 m	285 m
2500	FORWARD	640 ft	792 ft
		195 m	241 m
	AFT	611 ft	753 ft
		186 m	229 m
3000	FORWARD	531 ft	657 ft
		162 m	200 m
	AFT	511 ft	630 ft
		156 m	192 m
3500	FORWARD	454 ft	561 ft
		138 m	171 m

	AFT	439 ft 134 m	541 ft 165 m
4000	FORWARD	396 ft 121 m	490 ft 149 m
	AFT	385 ft 117 m	475 ft 145 m
4500	FORWARD	352 ft 107 m	435 ft 133 m
	AFT	343 ft 105 m	423 ft 129 m
5000	FORWARD	316 ft 96 m	391 ft 119 m
	AFT	309 ft 94 m	381 ft 116 m
	WIDTH	114 ft 35 m	127 ft 39 m

 FOOTPRINT FORWARD- distance beyond target.
 FOOTPRINT AFT- distance from target toward aircraft.
 FOOTPRINT WIDTH- total width at target.
 NOTE: -99 indicates an impossible alt./range combination

LASER FOOTPRINT TABLE for: LANTIRN
 Table based on: Flat terrain, Buffer= 2 mrad, Divergence= .18 mrad
 NOHD= 22700 meters (74456 feet or 12.3 nautical miles)

Table values are FOOTPRINT dimensions(feet and meters)

ALTITUDE (feet)	FOOTPRINT	SLANT RANGE (nautical miles, feet, and meters)	
		4.5 NM	5.0 NM
		27300 ft	30400 ft
		8330 m	9260 m
5000	FORWARD	316 ft	391 ft
		96 m	119 m
	AFT	309 ft	381 ft
		94 m	116 m
5500	FORWARD	287 ft	355 ft
		87 m	108 m
	AFT	281 ft	347 ft
		86 m	106 m
6000	FORWARD	263 ft	325 ft
		80 m	99 m
	AFT	258 ft	318 ft
		79 m	97 m
	WIDTH	114 ft	127 ft
		35 m	39 m

FOOTPRINT FORWARD- distance beyond target.
 FOOTPRINT AFT- distance from target toward aircraft.
 FOOTPRINT WIDTH- total width at target.
 NOTE: -99 indicates an impossible alt./range combination

LASER FOOTPRINT TABLE for: LANTIRN

Table based on: Flat terrain, Buffer= 2 mrad, Divergence= .18 mrad
 NOHD= 22700 meters (74456 feet or 12.3 nautical miles)

Medium

Table values are FOOTPRINT dimensions(feet and meters)

		SLANT RANGE (nautical miles, feet, and meters)							
ALTITUDE	FOOTPRINT	1.3 NM	1.5 NM	1.7 NM	1.9 NM	2.1 NM	2.3 NM		
(feet)		7900 ft	9110 ft	10300 ft	11500 ft	12800 ft	14000 ft		
		2410 m	2780 m	3150 m	3520 m	3890 m	4260 m		
8000	FORWARD	-99	22 ft	28 ft	35 ft	43 ft	51 ft		
		-99	7 m	9 m	11 m	13 m	16 m		
	AFT	-99	22 ft	28 ft	35 ft	42 ft	51 ft		
		-99	7 m	8 m	11 m	13 m	16 m		
9000	FORWARD	-99	19 ft	25 ft	31 ft	38 ft	45 ft		
		-99	6 m	8 m	9 m	12 m	14 m		
	AFT	-99	19 ft	25 ft	31 ft	38 ft	45 ft		
		-99	6 m	8 m	9 m	11 m	14 m		
10000	FORWARD	-99	-99	22 ft	28 ft	34 ft	41 ft		
		-99	-99	7 m	9 m	10 m	12 m		
	AFT	-99	-99	22 ft	28 ft	34 ft	41 ft		
		-99	-99	7 m	8 m	10 m	12 m		
11000	FORWARD	-99	-99	-99	25 ft	31 ft	37 ft		
		-99	-99	-99	8 m	9 m	11 m		
	AFT	-99	-99	-99	25 ft	31 ft	37 ft		
		-99	-99	-99	8 m	9 m	11 m		
12000	FORWARD	-99	-99	-99	-99	28 ft	34 ft		
		-99	-99	-99	-99	9 m	10 m		
	AFT	-99	-99	-99	-99	28 ft	34 ft		
		-99	-99	-99	-99	9 m	10 m		
13000	FORWARD	-99	-99	-99	-99	-99	31 ft		
		-99	-99	-99	-99	-99	10 m		
	AFT	-99	-99	-99	-99	-99	31 ft		
		-99	-99	-99	-99	-99	10 m		
14000	FORWARD	-99	-99	-99	-99	-99	-99		
		-99	-99	-99	-99	-99	-99		

FP3.TXT

AFT	-99	-99	-99	-99	-99	-99	-99
	-99	-99	-99	-99	-99	-99	-99
15000							
FORWARD	-99	-99	-99	-99	-99	-99	-99
	-99	-99	-99	-99	-99	-99	-99
AFT	-99	-99	-99	-99	-99	-99	-99
	-99	-99	-99	-99	-99	-99	-99
WIDTH	-99	38 ft	43 ft	48 ft	53 ft	58 ft	
	-99	12 m	13 m	15 m	16 m	18 m	

 FOOTPRINT FORWARD- distance beyond target.

FOOTPRINT AFT- distance from target toward aircraft.

FOOTPRINT WIDTH- total width at target.

NOTE: -99 indicates an impossible alt./range combination

 @

Buddy Lane

LASER FOOTPRINT TABLE for: LANTIRN

Table based on: Flat terrain, Buffer= 2 mrad, Divergence= .18 mrad
 NOHD= 22700 meters (74456 feet or 12.3 nautical miles)

Table values are FOOTPRINT dimensions(feet and meters)

ALTITUDE (feet)	FOOTPRINT	SLANT RANGE (nautical miles, feet, and meters)									
		0.8 NM	1.0 NM	1.2 NM	1.4 NM	1.6 NM	1.8 NM	2.0 NM			
500		4860 ft	6080 ft	7290 ft	8510 ft	9720 ft	10900 ft	12200 ft			
		1480 m	1850 m	2220 m	2590 m	2960 m	3330 m	3700 m			
	FORWARD	101 ft	158 ft	229 ft	314 ft	412 ft	524 ft	650 ft			
1000		31 m	48 m	70 m	96 m	126 m	160 m	198 m			
	AFT	97 ft	151 ft	216 ft	292 ft	380 ft	478 ft	587 ft			
		30 m	46 m	66 m	89 m	116 m	146 m	179 m			
1500	FORWARD	50 ft	78 ft	113 ft	154 ft	202 ft	256 ft	317 ft			
		15 m	24 m	34 m	47 m	61 m	78 m	97 m			
	AFT	49 ft	76 ft	109 ft	149 ft	194 ft	244 ft	301 ft			
2000		15 m	23 m	33 m	45 m	59 m	75 m	92 m			
	FORWARD	33 ft	52 ft	75 ft	102 ft	133 ft	169 ft	209 ft			
		10 m	16 m	23 m	31 m	41 m	52 m	64 m			
2500		33 ft	51 ft	73 ft	100 ft	130 ft	164 ft	202 ft			
		10 m	16 m	22 m	30 m	40 m	50 m	62 m			
	FORWARD	25 ft	39 ft	56 ft	76 ft	100 ft	126 ft	156 ft			
3000		8 m	12 m	17 m	23 m	30 m	39 m	48 m			
	AFT	25 ft	38 ft	55 ft	75 ft	98 ft	124 ft	152 ft			
		7 m	12 m	17 m	23 m	30 m	38 m	46 m			
3500	FORWARD	20 ft	31 ft	45 ft	61 ft	80 ft	101 ft	125 ft			
		6 m	9 m	14 m	19 m	24 m	31 m	38 m			
	AFT	20 ft	31 ft	44 ft	60 ft	78 ft	99 ft	122 ft			
4000		6 m	9 m	13 m	18 m	24 m	30 m	37 m			
	FORWARD	17 ft	26 ft	37 ft	51 ft	66 ft	84 ft	104 ft			
		5 m	8 m	11 m	15 m	20 m	26 m	32 m			
4500		16 ft	26 ft	37 ft	50 ft	65 ft	83 ft	102 ft			
		5 m	8 m	11 m	15 m	20 m	25 m	31 m			
	FORWARD	14 ft	22 ft	32 ft	43 ft	57 ft	72 ft	89 ft			
		4 m	7 m	10 m	13 m	17 m	22 m	27 m			

FP4.TXT

	AFT	14 ft 4 m	22 ft 7 m	32 ft 10 m	43 ft 13 m	56 ft 17 m	71 ft 22 m	88 ft 27 m
4000	FORWARD	12 ft 4 m	19 ft 6 m	28 ft 8 m	38 ft 12 m	50 ft 15 m	63 ft 19 m	78 ft 24 m
	AFT	12 ft 4 m	19 ft 6 m	28 ft 8 m	38 ft 11 m	49 ft 15 m	62 ft 19 m	77 ft 23 m
4500	FORWARD	11 ft 3 m	17 ft 5 m	25 ft 8 m	34 ft 10 m	44 ft 13 m	56 ft 17 m	69 ft 21 m
	AFT	11 ft 3 m	17 ft 5 m	25 ft 8 m	33 ft 10 m	44 ft 13 m	55 ft 17 m	68 ft 21 m
5000	FORWARD	-99	15 ft 5 m	22 ft 7 m	30 ft 9 m	40 ft 12 m	50 ft 15 m	62 ft 19 m
	AFT	-99	15 ft 5 m	22 ft 7 m	30 ft 9 m	39 ft 12 m	50 ft 15 m	61 ft 19 m
	WIDTH	20 ft 6 m	25 ft 8 m	30 ft 9 m	36 ft 11 m	41 ft 12 m	46 ft 14 m	51 ft 15 m

 FOOTPRINT FORWARD- distance beyond target.
 FOOTPRINT AFT- distance from target toward aircraft.
 FOOTPRINT WIDTH- total width at target.
 NOTE: -99 indicates an impossible alt./range combination

LASER FOOTPRINT TABLE for: LANTIRN

Table based on: Flat terrain, Buffer= 2 mrad, Divergence= .18 mrad
 NOHD= 2200 meters (74456 feet or 12.3 nautical miles)

Table values are FOOTPRINT dimensions(feet and meters)

ALTITUDE (feet)	FOOTPRINT	SLANT RANGE (nautical miles, feet, and meters)									
		0.8 NM	1.0 NM	1.2 NM	1.4 NM	1.6 NM	1.8 NM	2.0 NM			
5500		4860 ft	6080 ft	7290 ft	8510 ft	9720 ft	10900 ft	12200 ft			
		1480 m	1850 m	2220 m	2590 m	2960 m	3330 m	3700 m			
	FORWARD	-99	14 ft	20 ft	28 ft	36 ft	46 ft	56 ft			
	AFT	-99	4 m	6 m	8 m	11 m	14 m	17 m			
6000		-99	14 ft	20 ft	27 ft	36 ft	45 ft	56 ft			
		-99	4 m	6 m	8 m	11 m	14 m	17 m			
	FORWARD	-99	13 ft	19 ft	25 ft	33 ft	42 ft	52 ft			
	AFT	-99	4 m	6 m	8 m	10 m	13 m	16 m			
6500		-99	13 ft	18 ft	25 ft	33 ft	42 ft	51 ft			
		-99	4 m	6 m	8 m	10 m	13 m	16 m			
	FORWARD	-99	-99	17 ft	23 ft	30 ft	39 ft	48 ft			
	AFT	-99	-99	5 m	7 m	9 m	12 m	15 m			
7000		-99	-99	17 ft	23 ft	30 ft	38 ft	47 ft			
		-99	-99	5 m	7 m	9 m	12 m	14 m			
	FORWARD	-99	-99	16 ft	22 ft	28 ft	36 ft	44 ft			
	AFT	-99	-99	5 m	7 m	9 m	11 m	13 m			
7500		-99	-99	16 ft	22 ft	28 ft	36 ft	44 ft			
		-99	-99	5 m	7 m	9 m	11 m	13 m			
	FORWARD	-99	-99	-99	20 ft	26 ft	33 ft	41 ft			
	AFT	-99	-99	-99	6 m	8 m	10 m	13 m			
8000		-99	-99	-99	20 ft	26 ft	33 ft	41 ft			
		-99	-99	-99	6 m	8 m	10 m	13 m			
	FORWARD	-99	-99	-99	19 ft	25 ft	31 ft	39 ft			
	AFT	-99	-99	-99	6 m	8 m	10 m	12 m			
8500		-99	-99	-99	19 ft	25 ft	31 ft	38 ft			
		-99	-99	-99	6 m	8 m	10 m	12 m			
	FORWARD	-99	-99	-99	18 ft	23 ft	29 ft	36 ft			
	AFT	-99	-99	-99	5 m	7 m	9 m	11 m			

FP41.TXT

9000	AFT	-99	-99	-99	-99	18 ft	23 ft	29 ft	36 ft
		-99	-99	-99	-99	5 m	7 m	9 m	11 m
	FORWARD	-99	-99	-99	-99	-99	22 ft	28 ft	34 ft
		-99	-99	-99	-99	-99	7 m	8 m	10 m
9500	AFT	-99	-99	-99	-99	-99	22 ft	28 ft	34 ft
		-99	-99	-99	-99	-99	7 m	8 m	10 m
	FORWARD	-99	-99	-99	-99	-99	21 ft	26 ft	33 ft
		-99	-99	-99	-99	-99	6 m	8 m	10 m
10000	AFT	-99	-99	-99	-99	-99	21 ft	26 ft	32 ft
		-99	-99	-99	-99	-99	6 m	8 m	10 m
	FORWARD	-99	-99	-99	-99	-99	-99	25 ft	31 ft
		-99	-99	-99	-99	-99	-99	8 m	9 m
WIDTH		-99	-99	-99	-99	-99	-99	25 ft	31 ft
		-99	-99	-99	-99	-99	-99	8 m	9 m
		-99	-99	-99	-99	-99	-99	25 ft	31 ft
		-99	-99	-99	-99	-99	-99	8 m	9 m
FOOTPRINT FORWARD- distance beyond target. FOOTPRINT AFT- distance from target toward aircraft. FOOTPRINT WIDTH- total width at target. NOTE: -99 indicates an impossible alt./range combination									

LASER FOOTPRINT TABLE for: LANTIRN

Table based on: Flat terrain, Buffer= 2 mrad, Divergence= .18 mrad
 NOHD= 22700 meters (74456 feet or 12.3 nautical miles)

Table values are FOOTPRINT dimensions(feet and meters)

SLANT RANGE (nautical miles, feet, and meters)															
ALTITUDE (feet)	FOOTPRINT	0.8 NM		1.0 NM		1.2 NM		1.4 NM		1.6 NM		1.8 NM		2.0 NM	
		4860 ft 1480 m		6080 ft 1850 m		7290 ft 2220 m		8510 ft 2590 m		9720 ft 2960 m		10900 ft 3330 m		12200 ft 3700 m	
10500	FORWARD	-99		-99		-99		-99		-99		24 ft 7 m		29 ft 9 m	
	AFT	-99		-99		-99		-99		-99		24 ft 7 m		29 ft 9 m	
11000	FORWARD	-99		-99		-99		-99		-99					
	AFT	-99		-99		-99		-99		-99					
11500	FORWARD	-99		-99		-99		-99		-99					
	AFT	-99		-99		-99		-99		-99					
12000	FORWARD	-99		-99		-99		-99		-99					
	AFT	-99		-99		-99		-99		-99					
12500	FORWARD	-99		-99		-99		-99		-99					
	AFT	-99		-99		-99		-99		-99					
13000	FORWARD	-99		-99		-99		-99		-99					
	AFT	-99		-99		-99		-99		-99					
13500	FORWARD	-99		-99		-99		-99		-99					
	AFT	-99		-99		-99		-99		-99					

[illegible]

FOOTPRINT FORWARD- distance beyond target.
FOOTPRINT AFT- distance from target toward aircraft.
FOOTPRINT WIDTH- total width at target.
NOTE: -99 indicates an impossible alt./range combination

LASER FOOTPRINT TABLE for: LANTIRN

Table based on: Flat terrain, Buffer= 2 mrad, Divergence= .18 mrad
 NOHD= 22700 meters (74456 feet or 12.3 nautical miles)

Table values are FOOTPRINT dimensions(feet and meters)

ALTITUDE (feet)	FOOTPRINT	SLANT RANGE (nautical miles, feet, and meters)									
		0.8 NM	1.0 NM	1.2 NM	1.4 NM	1.6 NM	1.8 NM	2.0 NM			
		4860 ft 1480 m	6080 ft 1850 m	7290 ft 2220 m	8510 ft 2590 m	9720 ft 2960 m	10900 ft 3330 m	12200 ft 3700 m			
15500	FORWARD	-99	-99	-99	-99	-99	-99	-99	-99	-99	-99
	AFT	-99	-99	-99	-99	-99	-99	-99	-99	-99	-99
		-99	-99	-99	-99	-99	-99	-99	-99	-99	-99
16000	FORWARD	-99	-99	-99	-99	-99	-99	-99	-99	-99	-99
	AFT	-99	-99	-99	-99	-99	-99	-99	-99	-99	-99
		-99	-99	-99	-99	-99	-99	-99	-99	-99	-99
16500	FORWARD	-99	-99	-99	-99	-99	-99	-99	-99	-99	-99
	AFT	-99	-99	-99	-99	-99	-99	-99	-99	-99	-99
		-99	-99	-99	-99	-99	-99	-99	-99	-99	-99
17000	FORWARD	-99	-99	-99	-99	-99	-99	-99	-99	-99	-99
	AFT	-99	-99	-99	-99	-99	-99	-99	-99	-99	-99
		-99	-99	-99	-99	-99	-99	-99	-99	-99	-99
17500	FORWARD	-99	-99	-99	-99	-99	-99	-99	-99	-99	-99
	AFT	-99	-99	-99	-99	-99	-99	-99	-99	-99	-99
		-99	-99	-99	-99	-99	-99	-99	-99	-99	-99
18000	FORWARD	-99	-99	-99	-99	-99	-99	-99	-99	-99	-99
	AFT	-99	-99	-99	-99	-99	-99	-99	-99	-99	-99
		-99	-99	-99	-99	-99	-99	-99	-99	-99	-99
18500	FORWARD	-99	-99	-99	-99	-99	-99	-99	-99	-99	-99
	AFT	-99	-99	-99	-99	-99	-99	-99	-99	-99	-99
		-99	-99	-99	-99	-99	-99	-99	-99	-99	-99

FP43.TXT

19000	AFT	-99	-99	-99	-99	-99	-99	-99	-99
		-99	-99	-99	-99	-99	-99	-99	-99
	FORWARD	-99	-99	-99	-99	-99	-99	-99	-99
19500	AFT	-99	-99	-99	-99	-99	-99	-99	-99
		-99	-99	-99	-99	-99	-99	-99	-99
	FORWARD	-99	-99	-99	-99	-99	-99	-99	-99
20000	AFT	-99	-99	-99	-99	-99	-99	-99	-99
		-99	-99	-99	-99	-99	-99	-99	-99
	FORWARD	-99	-99	-99	-99	-99	-99	-99	-99
	WIDTH	-99	-99	-99	-99	-99	-99	-99	-99

 FOOTPRINT FORWARD- distance beyond target.
 FOOTPRINT AFT- distance from target toward aircraft.
 FOOTPRINT WIDTH- total width at target.
 NOTE: -99 indicates an impossible alt./range combination

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LASER FOOTPRINT TABLE for: PAVE TACK

Table based on: Flat terrain, Buffer= 2 mrad, Divergence= 1.8 mrad
 NOHD= 26600 meters (87248 feet or 14.4 nautical miles)

Loft

Table values are FOOTPRINT dimensions(feet and meters)

ALTITUDE (feet)	FOOTPRINT	SLANT RANGE (nautical miles, feet, and meters)									
		2.0 NM	2.5 NM	3.0 NM	3.5 NM	4.0 NM	4.5 NM	5.0 NM			
		12200 ft	15200 ft	18200 ft	21300 ft	24300 ft	27300 ft	30400 ft			
		3700 m	4630 m	5560 m	6480 m	7410 m	8330 m	9260 m			
500	FORWARD	921 ft	1470 ft	2150 ft	2990 ft	3990 ft	5150 ft	6500 ft			
		281 m	447 m	657 m	912 m	1220 m	1570 m	1980 m			
	AFT	800 ft	1230 ft	1740 ft	2340 ft	3000 ft	3740 ft	4550 ft			
		244 m	375 m	531 m	712 m	915 m	1140 m	1390 m			
1000	FORWARD	444 ft	700 ft	1020 ft	1400 ft	1840 ft	2350 ft	2940 ft			
		135 m	213 m	310 m	426 m	562 m	718 m	895 m			
	AFT	414 ft	641 ft	915 ft	1240 ft	1600 ft	2010 ft	2460 ft			
		126 m	195 m	279 m	377 m	488 m	612 m	750 m			
1500	FORWARD	292 ft	460 ft	666 ft	912 ft	1200 ft	1530 ft	1900 ft			
		89 m	140 m	203 m	278 m	365 m	465 m	578 m			
	AFT	279 ft	433 ft	621 ft	840 ft	1090 ft	1370 ft	1690 ft			
		85 m	132 m	189 m	256 m	332 m	418 m	514 m			
2000	FORWARD	218 ft	342 ft	495 ft	677 ft	888 ft	1130 ft	1400 ft			
		66 m	104 m	151 m	206 m	271 m	344 m	427 m			
	AFT	210 ft	327 ft	469 ft	636 ft	827 ft	1040 ft	1280 ft			
		64 m	100 m	143 m	194 m	252 m	318 m	391 m			
2500	FORWARD	174 ft	272 ft	394 ft	538 ft	705 ft	896 ft	1110 ft			
		53 m	83 m	120 m	164 m	215 m	273 m	338 m			
	AFT	169 ft	263 ft	378 ft	512 ft	667 ft	841 ft	1030 ft			
		52 m	80 m	115 m	156 m	203 m	256 m	315 m			
3000	FORWARD	144 ft	226 ft	327 ft	446 ft	585 ft	742 ft	919 ft			
		44 m	69 m	100 m	136 m	178 m	226 m	280 m			
	AFT	141 ft	220 ft	316 ft	428 ft	558 ft	704 ft	867 ft			
		43 m	67 m	96 m	131 m	170 m	215 m	264 m			
3500	FORWARD	124 ft	194 ft	279 ft	381 ft	499 ft	634 ft	784 ft			
		38 m	59 m	85 m	116 m	152 m	193 m	239 m			

T1.TXT

AFT	121 ft 37 m	189 ft 58 m	271 ft 83 m	368 ft 112 m	480 ft 146 m	606 ft 185 m	746 ft 227 m
4000							
FORWARD	108 ft 33 m	169 ft 52 m	244 ft 74 m	333 ft 101 m	436 ft 133 m	553 ft 169 m	684 ft 209 m
AFT	106 ft 32 m	166 ft 50 m	238 ft 72 m	323 ft 98 m	421 ft 128 m	532 ft 162 m	655 ft 200 m
4500							
FORWARD	96 ft 29 m	150 ft 46 m	217 ft 66 m	295 ft 90 m	387 ft 118 m	490 ft 149 m	607 ft 185 m
AFT	94 ft 29 m	147 ft 45 m	212 ft 65 m	288 ft 88 m	375 ft 114 m	474 ft 144 m	584 ft 178 m
5000							
FORWARD	86 ft 26 m	135 ft 41 m	195 ft 59 m	265 ft 81 m	347 ft 106 m	440 ft 134 m	545 ft 166 m
AFT	85 ft 26 m	133 ft 40 m	191 ft 58 m	259 ft 79 m	338 ft 103 m	427 ft 130 m	526 ft 160 m
WIDTH	70 ft 21 m	88 ft 27 m	106 ft 32 m	123 ft 38 m	141 ft 43 m	159 ft 48 m	176 ft 54 m

FOOTPRINT FORWARD- distance beyond target.

FOOTPRINT AFT- distance from target toward aircraft.

FOOTPRINT WIDTH- total width at target.

NOTE: -99 indicates an impossible alt./range combination

LASER FOOTPRINT TABLE for: PAVE TACK

Table based on: Flat terrain, Buffer= 2 mrad, Divergence= 1.8 mrad
 NOHD= 26600 meters (87248 feet or 14.4 nautical miles)

Table values are FOOTPRINT dimensions(feet and meters)

ALTITUDE (feet)	FOOTPRINT	SLANT RANGE (nautical miles, feet, and meters)									
		2.0 NM	2.5 NM	3.0 NM	3.5 NM	4.0 NM	4.5 NM	5.0 NM			
5000		12200 ft	15200 ft	18200 ft	21300 ft	24300 ft	27300 ft	30400 ft			
		3700 m	4630 m	5560 m	6480 m	7410 m	8330 m	9260 m			
	FORWARD	86 ft	135 ft	195 ft	265 ft	347 ft	440 ft	545 ft			
	AFT	26 m	41 m	59 m	81 m	106 m	134 m	166 m			
5500		85 ft	133 ft	191 ft	259 ft	338 ft	427 ft	526 ft			
		26 m	40 m	58 m	79 m	103 m	130 m	160 m			
	FORWARD	78 ft	123 ft	177 ft	241 ft	315 ft	400 ft	494 ft			
	AFT	24 m	37 m	54 m	73 m	96 m	122 m	151 m			
6000		77 ft	121 ft	174 ft	236 ft	308 ft	389 ft	479 ft			
		24 m	37 m	53 m	72 m	94 m	118 m	146 m			
	FORWARD	72 ft	112 ft	162 ft	221 ft	289 ft	366 ft	453 ft			
	AFT	22 m	34 m	49 m	67 m	88 m	112 m	138 m			
		71 ft	111 ft	159 ft	216 ft	282 ft	357 ft	440 ft			
		22 m	34 m	49 m	66 m	86 m	109 m	134 m			
	WIDTH	70 ft	88 ft	106 ft	123 ft	141 ft	159 ft	176 ft			
		21 m	27 m	32 m	38 m	43 m	48 m	54 m			

FOOTPRINT FORWARD- distance beyond target.

FOOTPRINT AFT- distance from target toward aircraft.

FOOTPRINT WIDTH- total width at target.

NOTE: -99 indicates an impossible alt./range combination

Medium

LASER FOOTPRINT TABLE for: PAVE TACK

Table based on: Flat terrain, Buffer= 2 mrad, Divergence= 1.8 mrad
 NOHD= 26600 meters (87248 feet or 14.4 nautical miles)

Table values are FOOTPRINT dimensions(feet and meters)

ALTITUDE (feet)	FOOTPRINT	SLANT RANGE (nautical miles, feet, and meters)							
		1.3 NM	1.5 NM	1.7 NM	1.9 NM	2.1 NM	2.3 NM		
		7900 ft	9110 ft	10300 ft	11500 ft	12800 ft	14000 ft		
		2410 m	2780 m	3150 m	3520 m	3890 m	4260 m		
8000	FORWARD	-99	30 ft	39 ft	48 ft	59 ft	71 ft		
		-99	9 m	12 m	15 m	18 m	22 m		
	AFT	-99	30 ft	39 ft	48 ft	59 ft	71 ft		
		-99	9 m	12 m	15 m	18 m	21 m		
9000	FORWARD	-99	27 ft	34 ft	43 ft	53 ft	63 ft		
		-99	8 m	10 m	13 m	16 m	19 m		
	AFT	-99	27 ft	34 ft	43 ft	52 ft	63 ft		
		-99	8 m	10 m	13 m	16 m	19 m		
10000	FORWARD	-99	-99	31 ft	39 ft	47 ft	57 ft		
		-99	-99	9 m	12 m	14 m	17 m		
	AFT	-99	-99	31 ft	39 ft	47 ft	56 ft		
		-99	-99	9 m	12 m	14 m	17 m		
11000	FORWARD	-99	-99	-99	35 ft	43 ft	52 ft		
		-99	-99	-99	11 m	13 m	16 m		
	AFT	-99	-99	-99	35 ft	43 ft	51 ft		
		-99	-99	-99	11 m	13 m	16 m		
12000	FORWARD	-99	-99	-99	-99	39 ft	47 ft		
		-99	-99	-99	-99	12 m	14 m		
	AFT	-99	-99	-99	-99	39 ft	47 ft		
		-99	-99	-99	-99	12 m	14 m		
13000	FORWARD	-99	-99	-99	-99	-99	44 ft		
		-99	-99	-99	-99	-99	13 m		
	AFT	-99	-99	-99	-99	-99	44 ft		
		-99	-99	-99	-99	-99	13 m		
14000	FORWARD	-99	-99	-99	-99	-99	-99		
		-99	-99	-99	-99	-99	-99		

T2.TXT

AFT	-99	-99	-99	-99	-99	-99	-99
	-99	-99	-99	-99	-99	-99	-99
15000							
FORWARD	-99	-99	-99	-99	-99	-99	-99
	-99	-99	-99	-99	-99	-99	-99
AFT	-99	-99	-99	-99	-99	-99	-99
	-99	-99	-99	-99	-99	-99	-99
WIDTH	-99	53 ft	60 ft	67 ft	74 ft	81 ft	
	-99	16 m	18 m	20 m	23 m	25 m	

 FOOTPRINT FORWARD- distance beyond target.

FOOTPRINT AFT- distance from target toward aircraft.

FOOTPRINT WIDTH- total width at target.

NOTE: -99 indicates an impossible alt./range combination

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Buddy Lase

LASER FOOTPRINT TABLE for: PAVE TACK

Table based on: Flat terrain, Buffer= 2 mrad, Divergence= 1.8 mrad
 NOHD= 26600 meters (87248 feet or 14.4 nautical miles)

Table values are FOOTPRINT dimensions(feet and meters)

ALTITUDE (feet)	FOOTPRINT	SLANT RANGE (nautical miles, feet, and meters)									
		0.8 NM	1.0 NM	1.2 NM	1.4 NM	1.6 NM	1.8 NM	2.0 NM			
		4860 ft	6080 ft	7290 ft	8510 ft	9720 ft	10900 ft	12200 ft			
		1480 m	1850 m	2220 m	2590 m	2960 m	3330 m	3700 m			
500	FORWARD	141 ft	222 ft	322 ft	441 ft	581 ft	741 ft	921 ft			
		43 m	68 m	98 m	135 m	177 m	226 m	281 m			
	AFT	133 ft	207 ft	296 ft	400 ft	519 ft	652 ft	800 ft			
		41 m	63 m	90 m	122 m	158 m	199 m	244 m			
1000	FORWARD	69 ft	109 ft	157 ft	215 ft	282 ft	358 ft	444 ft			
		21 m	33 m	48 m	66 m	86 m	109 m	135 m			
	AFT	68 ft	105 ft	151 ft	205 ft	267 ft	336 ft	414 ft			
		21 m	32 m	46 m	62 m	81 m	102 m	126 m			
1500	FORWARD	46 ft	72 ft	104 ft	142 ft	186 ft	236 ft	292 ft			
		14 m	22 m	32 m	43 m	57 m	72 m	89 m			
	AFT	45 ft	71 ft	101 ft	138 ft	179 ft	227 ft	279 ft			
		14 m	22 m	31 m	42 m	55 m	69 m	85 m			
2000	FORWARD	34 ft	54 ft	78 ft	106 ft	139 ft	176 ft	218 ft			
		11 m	16 m	24 m	32 m	42 m	54 m	66 m			
	AFT	34 ft	53 ft	76 ft	104 ft	135 ft	171 ft	210 ft			
		10 m	16 m	23 m	32 m	41 m	52 m	64 m			
2500	FORWARD	28 ft	43 ft	62 ft	85 ft	111 ft	140 ft	174 ft			
		8 m	13 m	19 m	26 m	34 m	43 m	53 m			
	AFT	27 ft	43 ft	61 ft	83 ft	108 ft	137 ft	169 ft			
		8 m	13 m	19 m	25 m	33 m	42 m	52 m			
3000	FORWARD	23 ft	36 ft	52 ft	70 ft	92 ft	117 ft	144 ft			
		7 m	11 m	16 m	21 m	28 m	36 m	44 m			
	AFT	23 ft	36 ft	51 ft	69 ft	91 ft	114 ft	141 ft			
		7 m	11 m	16 m	21 m	28 m	35 m	43 m			
3500	FORWARD	20 ft	31 ft	44 ft	60 ft	79 ft	100 ft	124 ft			
		6 m	9 m	13 m	18 m	24 m	30 m	38 m			

T3.TXT

4000	AFT	20 ft 6 m	30 ft 9 m	44 ft 13 m	60 ft 18 m	78 ft 24 m	98 ft 30 m	121 ft 37 m
	FORWARD	17 ft 5 m	27 ft 8 m	39 ft 12 m	53 ft 16 m	69 ft 21 m	87 ft 27 m	108 ft 33 m
	AFT	17 ft 5 m	27 ft 8 m	38 ft 12 m	52 ft 16 m	68 ft 21 m	86 ft 26 m	106 ft 32 m
4500	FORWARD	15 ft 5 m	24 ft 7 m	34 ft 10 m	47 ft 14 m	61 ft 19 m	78 ft 24 m	96 ft 29 m
	AFT	15 ft 5 m	24 ft 7 m	34 ft 10 m	46 ft 14 m	61 ft 18 m	77 ft 23 m	94 ft 29 m
	FORWARD	-99	21 ft 7 m	31 ft 9 m	42 ft 13 m	55 ft 17 m	70 ft 21 m	86 ft 26 m
5000	AFT	-99	21 ft 7 m	31 ft 9 m	42 ft 13 m	55 ft 17 m	69 ft 21 m	85 ft 26 m
	FORWARD	-99	21 ft 7 m	31 ft 9 m	42 ft 13 m	55 ft 17 m	70 ft 21 m	86 ft 26 m
	WIDTH	28 ft 9 m	35 ft 11 m	42 ft 13 m	49 ft 15 m	56 ft 17 m	63 ft 19 m	70 ft 21 m

FOOTPRINT FORWARD- distance beyond target.

FOOTPRINT AFT- distance from target toward aircraft.

FOOTPRINT WIDTH- total width at target.

NOTE: -99 indicates an impossible alt./range combination

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LASER FOOTPRINT TABLE for: PAVE TACK

Table based on: Flat terrain, Buffer= 2 mrad, Divergence= 1.8 mrad
 NOHD= 26600 meters (87248 feet or 14.4 nautical miles)

Table values are FOOTPRINT dimensions(feet and meters)

ALTITUDE (feet)	FOOTPRINT	SLANT RANGE (nautical miles, feet, and meters)									
		0.8 NM	1.0 NM	1.2 NM	1.4 NM	1.6 NM	1.8 NM	2.0 NM			
		4860 ft	6080 ft	7290 ft	8510 ft	9720 ft	10900 ft	12200 ft			
		1480 m	1850 m	2220 m	2590 m	2960 m	3330 m	3700 m			
5500	FORWARD	-99	19 ft	28 ft	38 ft	50 ft	63 ft	78 ft			
		-99	6 m	9 m	12 m	15 m	19 m	24 m			
	AFT	-99	19 ft	28 ft	38 ft	50 ft	63 ft	77 ft			
		-99	6 m	9 m	12 m	15 m	19 m	24 m			
6000	FORWARD	-99	18 ft	26 ft	35 ft	46 ft	58 ft	72 ft			
		-99	5 m	8 m	11 m	14 m	18 m	22 m			
	AFT	-99	18 ft	26 ft	35 ft	46 ft	58 ft	71 ft			
		-99	5 m	8 m	11 m	14 m	18 m	22 m			
6500	FORWARD	-99	-99	24 ft	32 ft	42 ft	54 ft	66 ft			
		-99	-99	7 m	10 m	13 m	16 m	20 m			
	AFT	-99	-99	24 ft	32 ft	42 ft	53 ft	66 ft			
		-99	-99	7 m	10 m	13 m	16 m	20 m			
7000	FORWARD	-99	-99	22 ft	30 ft	39 ft	50 ft	61 ft			
		-99	-99	7 m	9 m	12 m	15 m	19 m			
	AFT	-99	-99	22 ft	30 ft	39 ft	49 ft	61 ft			
		-99	-99	7 m	9 m	12 m	15 m	19 m			
7500	FORWARD	-99	-99	-99	28 ft	37 ft	46 ft	57 ft			
		-99	-99	-99	9 m	11 m	14 m	17 m			
	AFT	-99	-99	-99	28 ft	36 ft	46 ft	57 ft			
		-99	-99	-99	9 m	11 m	14 m	17 m			
8000	FORWARD	-99	-99	-99	26 ft	34 ft	43 ft	54 ft			
		-99	-99	-99	8 m	10 m	13 m	16 m			
	AFT	-99	-99	-99	26 ft	34 ft	43 ft	53 ft			
		-99	-99	-99	8 m	10 m	13 m	16 m			
8500	FORWARD	-99	-99	-99	25 ft	32 ft	41 ft	51 ft			
		-99	-99	-99	8 m	10 m	12 m	15 m			

9000	AFT	-99	-99	-99	25 ft	32 ft	41 ft	50 ft
		-99	-99	-99	8 m	10 m	12 m	15 m
9500	FORWARD	-99	-99	-99	-99	30 ft	39 ft	48 ft
		-99	-99	-99	-99	9 m	12 m	15 m
	AFT	-99	-99	-99	-99	30 ft	38 ft	47 ft
		-99	-99	-99	-99	9 m	12 m	14 m
9500	FORWARD	-99	-99	-99	-99	29 ft	37 ft	45 ft
		-99	-99	-99	-99	9 m	11 m	14 m
	AFT	-99	-99	-99	-99	29 ft	36 ft	45 ft
		-99	-99	-99	-99	9 m	11 m	14 m
10000	FORWARD	-99	-99	-99	-99	-99	35 ft	43 ft
		-99	-99	-99	-99	-99	11 m	13 m
	AFT	-99	-99	-99	-99	-99	35 ft	43 ft
		-99	-99	-99	-99	-99	11 m	13 m
WIDTH		-99	35 ft	42 ft	49 ft	56 ft	63 ft	70 ft
		-99	11 m	13 m	15 m	17 m	19 m	21 m

FOOTPRINT FORWARD- distance beyond target.

FOOTPRINT AFT- distance from target toward aircraft.

FOOTPRINT WIDTH- total width at target.

NOTE: -99 indicates an impossible alt./range combination

LASER FOOTPRINT TABLE for: PAVE TACK

Table based on: Flat terrain, Buffer= 2 mrad, Divergence= 1.8 mrad
 NOHD= 26600 meters (87248 feet or 14.4 nautical miles)

Table values are FOOTPRINT dimensions(feet and meters)

		SLANT RANGE (nautical miles, feet, and meters)									
ALTITUDE (feet)	FOOTPRINT	0.8 NM 4860 ft 1480 m	1.0 NM 6080 ft 1850 m	1.2 NM 7290 ft 2220 m	1.4 NM 8510 ft 2590 m	1.6 NM 9720 ft 2960 m	1.8 NM 10900 ft 3330 m	2.0 NM 12200 ft 3700 m			
10500	FORWARD	-99	-99	-99	-99	-99	33 ft	41 ft			
	AFT	-99	-99	-99	-99	-99	10 m	12 m			
11000	FORWARD	-99	-99	-99	-99	-99	33 ft	41 ft			
	AFT	-99	-99	-99	-99	-99	10 m	12 m			
11500	FORWARD	-99	-99	-99	-99	-99	-99	39 ft			
	AFT	-99	-99	-99	-99	-99	-99	12 m			
12000	FORWARD	-99	-99	-99	-99	-99	-99	37 ft			
	AFT	-99	-99	-99	-99	-99	-99	11 m			
12500	FORWARD	-99	-99	-99	-99	-99	-99	37 ft			
	AFT	-99	-99	-99	-99	-99	-99	11 m			
13000	FORWARD	-99	-99	-99	-99	-99	-99	36 ft			
	AFT	-99	-99	-99	-99	-99	-99	11 m			
13500	FORWARD	-99	-99	-99	-99	-99	-99	36 ft			
	AFT	-99	-99	-99	-99	-99	-99	11 m			

[illegible]

FOOTPRINT FORWARD- distance beyond target.
FOOTPRINT AFT- distance from target toward aircraft.
FOOTPRINT WIDTH- total width at target.
NOTE: -99 indicates an impossible alt./range combination

LASER FOOTPRINT TABLE for: PAVE TACK

Table based on: Flat terrain, Buffer= 2 mrad, Divergence= 1.8 mrad
 NOHD= 26600 meters (87248 feet or 14.4 nautical miles)

Table values are FOOTPRINT dimensions(feet and meters)

		SLANT RANGE (nautical miles, feet, and meters)									
ALTITUDE (feet)	FOOTPRINT	0.8 NM	1.0 NM	1.2 NM	1.4 NM	1.6 NM	1.8 NM	2.0 NM			
		4860 ft 1480 m	6080 ft 1850 m	7290 ft 2220 m	8510 ft 2590 m	9720 ft 2960 m	10900 ft 3330 m	12200 ft 3700 m			
15500	FORWARD	-99	-99	-99	-99	-99	-99	-99	-99	-99	-99
	AFT	-99	-99	-99	-99	-99	-99	-99	-99	-99	-99
	FORWARD	-99	-99	-99	-99	-99	-99	-99	-99	-99	-99
	AFT	-99	-99	-99	-99	-99	-99	-99	-99	-99	-99
16000	FORWARD	-99	-99	-99	-99	-99	-99	-99	-99	-99	-99
	AFT	-99	-99	-99	-99	-99	-99	-99	-99	-99	-99
	FORWARD	-99	-99	-99	-99	-99	-99	-99	-99	-99	-99
	AFT	-99	-99	-99	-99	-99	-99	-99	-99	-99	-99
16500	FORWARD	-99	-99	-99	-99	-99	-99	-99	-99	-99	-99
	AFT	-99	-99	-99	-99	-99	-99	-99	-99	-99	-99
	FORWARD	-99	-99	-99	-99	-99	-99	-99	-99	-99	-99
	AFT	-99	-99	-99	-99	-99	-99	-99	-99	-99	-99
17000	FORWARD	-99	-99	-99	-99	-99	-99	-99	-99	-99	-99
	AFT	-99	-99	-99	-99	-99	-99	-99	-99	-99	-99
	FORWARD	-99	-99	-99	-99	-99	-99	-99	-99	-99	-99
	AFT	-99	-99	-99	-99	-99	-99	-99	-99	-99	-99
17500	FORWARD	-99	-99	-99	-99	-99	-99	-99	-99	-99	-99
	AFT	-99	-99	-99	-99	-99	-99	-99	-99	-99	-99
	FORWARD	-99	-99	-99	-99	-99	-99	-99	-99	-99	-99
	AFT	-99	-99	-99	-99	-99	-99	-99	-99	-99	-99
18000	FORWARD	-99	-99	-99	-99	-99	-99	-99	-99	-99	-99
	AFT	-99	-99	-99	-99	-99	-99	-99	-99	-99	-99
	FORWARD	-99	-99	-99	-99	-99	-99	-99	-99	-99	-99
	AFT	-99	-99	-99	-99	-99	-99	-99	-99	-99	-99
18500	FORWARD	-99	-99	-99	-99	-99	-99	-99	-99	-99	-99
	AFT	-99	-99	-99	-99	-99	-99	-99	-99	-99	-99

T33.TXT

AFT	-99	-99	-99	-99	-99	-99	-99	-99	-99
	-99	-99	-99	-99	-99	-99	-99	-99	-99
19000	FORWARD	-99	-99	-99	-99	-99	-99	-99	-99
		-99	-99	-99	-99	-99	-99	-99	-99
AFT	-99	-99	-99	-99	-99	-99	-99	-99	-99
	-99	-99	-99	-99	-99	-99	-99	-99	-99
19500	FORWARD	-99	-99	-99	-99	-99	-99	-99	-99
		-99	-99	-99	-99	-99	-99	-99	-99
AFT	-99	-99	-99	-99	-99	-99	-99	-99	-99
	-99	-99	-99	-99	-99	-99	-99	-99	-99
20000	FORWARD	-99	-99	-99	-99	-99	-99	-99	-99
		-99	-99	-99	-99	-99	-99	-99	-99
AFT	-99	-99	-99	-99	-99	-99	-99	-99	-99
	-99	-99	-99	-99	-99	-99	-99	-99	-99
WIDTH	-99	-99	-99	-99	-99	-99	-99	-99	-99
	-99	-99	-99	-99	-99	-99	-99	-99	-99

 FOOTPRINT FORWARD- distance beyond target.
 FOOTPRINT AFT- distance from target toward aircraft.
 FOOTPRINT WIDTH- total width at target.
 NOTE: -99 indicates an impossible alt./range combination

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Loft

LASER FOOTPRINT TABLE for: PAVE SPIKE

Table based on: Flat terrain, Buffer= 2.5 mrad, Divergence= .35 mrad
 NOHD= 10400 meters (34112 feet or 5.6 nautical miles)

Table values are FOOTPRINT dimensions(feet and meters)

		SLANT RANGE (nautical miles, feet, and meters)									
ALTITUDE (feet)	FOOTPRINT	2.0 NM	2.5 NM	3.0 NM	3.5 NM	4.0 NM	4.5 NM	5.0 NM			
		12200 ft 3700 m	15200 ft 4630 m	18200 ft 5560 m	21300 ft 6480 m	24300 ft 7410 m	27300 ft 8330 m	30400 ft 9260 m			
500	FORWARD	845 ft	1340 ft	1970 ft	2730 ft	3630 ft	4680 ft	3730 ft			
	AFT	258 m	410 m	600 m	832 m	1110 m	1430 m	1140 m			
1000	FORWARD	742 ft	1140 ft	1620 ft	2170 ft	2800 ft	3490 ft	4250 ft			
	AFT	226 m	348 m	494 m	662 m	852 m	1060 m	1290 m			
1500	FORWARD	408 ft	643 ft	934 ft	1280 ft	1690 ft	2160 ft	2690 ft			
	AFT	124 m	196 m	285 m	391 m	515 m	658 m	819 m			
2000	FORWARD	383 ft	593 ft	848 ft	1140 ft	1480 ft	1860 ft	2280 ft			
	AFT	117 m	181 m	258 m	349 m	452 m	568 m	696 m			
2500	FORWARD	269 ft	423 ft	612 ft	838 ft	1100 ft	1400 ft	1740 ft			
	AFT	82 m	129 m	187 m	255 m	336 m	427 m	530 m			
3000	FORWARD	258 ft	401 ft	574 ft	777 ft	1010 ft	1270 ft	1560 ft			
	AFT	79 m	122 m	175 m	237 m	308 m	388 m	476 m			
3500	FORWARD	201 ft	315 ft	455 ft	623 ft	817 ft	1040 ft	1290 ft			
	AFT	61 m	96 m	139 m	190 m	249 m	316 m	392 m			
4000	FORWARD	194 ft	303 ft	434 ft	588 ft	765 ft	965 ft	1190 ft			
	AFT	59 m	92 m	132 m	179 m	233 m	294 m	362 m			
4500	FORWARD	160 ft	251 ft	363 ft	495 ft	649 ft	824 ft	1020 ft			
	AFT	49 m	76 m	111 m	151 m	198 m	251 m	311 m			
5000	FORWARD	156 ft	243 ft	349 ft	473 ft	616 ft	777 ft	957 ft			
	AFT	48 m	74 m	106 m	144 m	188 m	237 m	292 m			
5500	FORWARD	133 ft	209 ft	301 ft	411 ft	538 ft	683 ft	846 ft			
	AFT	41 m	64 m	92 m	125 m	164 m	208 m	258 m			
6000	FORWARD	130 ft	203 ft	292 ft	396 ft	516 ft	651 ft	801 ft			
	AFT	40 m	62 m	89 m	121 m	157 m	198 m	244 m			
6500	FORWARD	114 ft	178 ft	257 ft	351 ft	460 ft	583 ft	722 ft			
	AFT	35 m	54 m	78 m	107 m	140 m	178 m	220 m			

SL.TXT

4000	AFT	112 ft 34 m	174 ft 53 m	251 ft 76 m	340 ft 104 m	443 ft 135 m	560 ft 171 m	690 ft 210 m
	FORWARD	100 ft 30 m	156 ft 47 m	225 ft 69 m	307 ft 93 m	401 ft 122 m	509 ft 155 m	630 ft 192 m
4500	AFT	98 ft 30 m	153 ft 47 m	220 ft 67 m	298 ft 91 m	389 ft 119 m	491 ft 150 m	605 ft 184 m
	FORWARD	88 ft 27 m	138 ft 42 m	200 ft 61 m	272 ft 83 m	356 ft 109 m	452 ft 138 m	559 ft 170 m
5000	AFT	87 ft 27 m	136 ft 41 m	195 ft 60 m	266 ft 81 m	346 ft 106 m	437 ft 133 m	539 ft 164 m
	FORWARD	79 ft 24 m	124 ft 38 m	179 ft 55 m	245 ft 75 m	320 ft 98 m	406 ft 124 m	502 ft 153 m
WIDTH	AFT	79 ft 24 m	123 ft 37 m	176 ft 54 m	239 ft 73 m	312 ft 95 m	394 ft 120 m	486 ft 148 m
	FORWARD	65 ft 20 m	81 ft 25 m	98 ft 30 m	114 ft 35 m	130 ft 40 m	146 ft 45 m	163 ft 50 m

 FOOTPRINT FORWARD- distance beyond target.
 FOOTPRINT AFT- distance from target toward aircraft.
 FOOTPRINT WIDTH- total width at target.
 NOTE: -99 indicates an impossible alt./range combination

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LASER FOOTPRINT TABLE for: PAVE SPIKE

Table based on: Flat terrain, Buffer= 2.5 mrad, Divergence= .35 mrad
 NOHD= 10400 meters (34112 feet or 5.6 nautical miles)

Table values are FOOTPRINT dimensions(feet and meters)

ALTITUDE (feet)	FOOTPRINT	SLANT RANGE (nautical miles, feet, and meters)									
		2.0 NM	2.5 NM	3.0 NM	3.5 NM	4.0 NM	4.5 NM	5.0 NM			
		12200 ft	15200 ft	18200 ft	21300 ft	24300 ft	27300 ft	30400 ft			
		3700 m	4630 m	5560 m	6480 m	7410 m	8330 m	9260 m			
5000	FORWARD	79 ft	124 ft	179 ft	245 ft	320 ft	406 ft	502 ft			
		24 m	38 m	55 m	75 m	98 m	124 m	153 m			
	AFT	79 ft	123 ft	176 ft	239 ft	312 ft	394 ft	486 ft			
		24 m	37 m	54 m	73 m	95 m	120 m	148 m			
5500	FORWARD	72 ft	113 ft	163 ft	222 ft	291 ft	368 ft	456 ft			
		22 m	34 m	50 m	68 m	89 m	112 m	139 m			
	AFT	71 ft	111 ft	160 ft	218 ft	284 ft	359 ft	442 ft			
		22 m	34 m	49 m	66 m	87 m	109 m	135 m			
6000	FORWARD	66 ft	104 ft	149 ft	203 ft	266 ft	337 ft	417 ft			
		20 m	32 m	46 m	62 m	81 m	103 m	127 m			
	AFT	66 ft	102 ft	147 ft	200 ft	261 ft	329 ft	406 ft			
		20 m	31 m	45 m	61 m	79 m	100 m	124 m			
	WIDTH	65 ft	81 ft	98 ft	114 ft	130 ft	146 ft	163 ft			
		20 m	25 m	30 m	35 m	40 m	45 m	50 m			

FOOTPRINT FORWARD- distance beyond target.

FOOTPRINT AFT- distance from target toward aircraft.

FOOTPRINT WIDTH- total width at target.

NOTE: -99 indicates an impossible alt./range combination

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LASER FOOTPRINT TABLE for: PAVE SPIKE

Table based on: Flat terrain, Buffer= 2.5 mrad, Divergence= .35 mrad
 NOHD= 10400 meters (34112 feet or 5.6 nautical miles)

Medium

Table values are FOOTPRINT dimensions(feet and meters)

		SLANT RANGE (nautical miles, feet, and meters)							
ALTITUDE (feet)	FOOTPRINT	1.3 NM	1.5 NM	1.7 NM	1.9 NM	2.1 NM	2.3 NM		
		7900 ft 2410 m	9110 ft 2780 m	10300 ft 3150 m	11500 ft 3520 m	12800 ft 3890 m	14000 ft 4260 m		
8000	FORWARD	-99	28 ft 8 m	36 ft 11 m	45 ft 14 m	55 ft 17 m	66 ft 20 m		
	AFT	-99	28 ft 8 m	36 ft 11 m	44 ft 14 m	54 ft 17 m	65 ft 20 m		
	FORWARD	-99	25 ft 8 m	32 ft 10 m	40 ft 12 m	49 ft 15 m	58 ft 18 m		
	AFT	-99	25 ft 8 m	32 ft 10 m	40 ft 12 m	48 ft 15 m	58 ft 18 m		
10000	FORWARD	-99	-99	29 ft 9 m	36 ft 11 m	44 ft 13 m	52 ft 16 m		
	AFT	-99	-99	29 ft 9 m	36 ft 11 m	43 ft 13 m	52 ft 16 m		
	FORWARD	-99	-99	-99	32 ft 10 m	40 ft 12 m	48 ft 15 m		
	AFT	-99	-99	-99	32 ft 10 m	40 ft 12 m	47 ft 14 m		
12000	FORWARD	-99	-99	-99	-99	36 ft 11 m	44 ft 13 m		
	AFT	-99	-99	-99	-99	36 ft 11 m	43 ft 13 m		
	FORWARD	-99	-99	-99	-99	-99	40 ft 12 m		
	AFT	-99	-99	-99	-99	-99	40 ft 12 m		
13000	FORWARD	-99	-99	-99	-99	-99	-99		
	AFT	-99	-99	-99	-99	-99	-99		
	FORWARD	-99	-99	-99	-99	-99	-99		
	AFT	-99	-99	-99	-99	-99	-99		
14000	FORWARD	-99	-99	-99	-99	-99	-99		
	AFT	-99	-99	-99	-99	-99	-99		
	FORWARD	-99	-99	-99	-99	-99	-99		
	AFT	-99	-99	-99	-99	-99	-99		

S2.TXT

AFT	-99	-99	-99	-99	-99	-99	-99	-99	-99
	-99	-99	-99	-99	-99	-99	-99	-99	-99
15000									
FORWARD	-99	-99	-99	-99	-99	-99	-99	-99	-99
	-99	-99	-99	-99	-99	-99	-99	-99	-99
AFT	-99	-99	-99	-99	-99	-99	-99	-99	-99
	-99	-99	-99	-99	-99	-99	-99	-99	-99
WIDTH	-99	49 ft	55 ft	62 ft	68 ft	75 ft			
	-99	15 m	17 m	19 m	21 m	23 m			

 FOOTPRINT FORWARD- distance beyond target.

FOOTPRINT AFT- distance from target toward aircraft.

FOOTPRINT WIDTH- total width at target.

NOTE: -99 indicates an impossible alt./range combination

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Buddy Laser

LASER FOOTPRINT TABLE for: PAVE SPIKE

Table based on: Flat terrain, Buffer= 2.5 mrad, Divergence= .35 mrad
 NOHD= 10400 meters (34112 feet or 5.6 nautical miles)

Table values are FOOTPRINT dimensions(feet and meters)

ALTITUDE (feet)	FOOTPRINT	SLANT RANGE (nautical miles, feet, and meters)							
		0.8 NM	1.0 NM	1.2 NM	1.4 NM	1.6 NM	1.8 NM	2.0 NM	
500		4860 ft	6080 ft	7290 ft	8510 ft	9720 ft	10900 ft	12200 ft	
		1480 m	1850 m	2220 m	2590 m	2960 m	3330 m	3700 m	
	FORWARD	130 ft	204 ft	296 ft	406 ft	533 ft	680 ft	845 ft	
1000		40 m	62 m	90 m	124 m	163 m	207 m	258 m	
		123 ft	191 ft	274 ft	370 ft	481 ft	605 ft	742 ft	
	AFT	38 m	58 m	83 m	113 m	147 m	184 m	226 m	
1500	FORWARD	64 ft	100 ft	145 ft	198 ft	260 ft	330 ft	408 ft	
		20 m	31 m	44 m	60 m	79 m	100 m	124 m	
	AFT	62 ft	97 ft	140 ft	189 ft	246 ft	311 ft	383 ft	
2000		19 m	30 m	43 m	58 m	75 m	95 m	117 m	
	FORWARD	42 ft	67 ft	96 ft	131 ft	171 ft	218 ft	269 ft	
	AFT	13 m	20 m	29 m	40 m	52 m	66 m	82 m	
2500		42 ft	65 ft	94 ft	127 ft	166 ft	209 ft	258 ft	
		13 m	20 m	29 m	39 m	51 m	64 m	79 m	
	FORWARD	32 ft	50 ft	72 ft	98 ft	128 ft	162 ft	201 ft	
3000		10 m	15 m	22 m	30 m	39 m	49 m	61 m	
		31 ft	49 ft	70 ft	96 ft	125 ft	158 ft	194 ft	
	AFT	10 m	15 m	21 m	29 m	38 m	48 m	59 m	
3500	FORWARD	25 ft	40 ft	57 ft	78 ft	102 ft	129 ft	160 ft	
		8 m	12 m	17 m	24 m	31 m	39 m	49 m	
	AFT	25 ft	39 ft	56 ft	77 ft	100 ft	127 ft	156 ft	
4000		8 m	12 m	17 m	23 m	31 m	39 m	48 m	
	FORWARD	21 ft	33 ft	48 ft	65 ft	85 ft	108 ft	133 ft	
	AFT	6 m	10 m	15 m	20 m	26 m	33 m	41 m	
4500		21 ft	33 ft	47 ft	64 ft	84 ft	106 ft	130 ft	
		6 m	10 m	14 m	20 m	25 m	32 m	40 m	
	FORWARD	18 ft	28 ft	41 ft	56 ft	73 ft	92 ft	114 ft	
5000		6 m	9 m	12 m	17 m	22 m	28 m	35 m	

S3.TXT

	AFT	18 ft 5 m	28 ft 9 m	40 ft 12 m	55 ft 17 m	72 ft 22 m	91 ft 28 m	112 ft 34 m
4000	FORWARD	16 ft 5 m	25 ft 8 m	36 ft 11 m	49 ft 15 m	64 ft 19 m	81 ft 25 m	100 ft 30 m
	AFT	16 ft 5 m	25 ft 8 m	35 ft 11 m	48 ft 15 m	63 ft 19 m	79 ft 24 m	98 ft 30 m
4500	FORWARD	14 ft 4 m	22 ft 7 m	32 ft 10 m	43 ft 13 m	56 ft 17 m	72 ft 22 m	88 ft 27 m
	AFT	14 ft 4 m	22 ft 7 m	31 ft 10 m	43 ft 13 m	56 ft 17 m	71 ft 22 m	87 ft 27 m
5000	FORWARD	-99	20 ft 6 m	29 ft 9 m	39 ft 12 m	51 ft 15 m	64 ft 20 m	79 ft 24 m
	AFT	-99	20 ft 6 m	28 ft 9 m	39 ft 12 m	50 ft 15 m	64 ft 19 m	79 ft 24 m
	WIDTH	26 ft 8 m	33 ft 10 m	39 ft 12 m	46 ft 14 m	52 ft 16 m	59 ft 18 m	65 ft 20 m

FOOTPRINT FORWARD- distance beyond target.

FOOTPRINT AFT- distance from target toward aircraft.

FOOTPRINT WIDTH- total width at target.

NOTE: -99 indicates an impossible alt./range combination

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LASER FOOTPRINT TABLE for: PAVE SPIKE

Table based on: Flat terrain, Buffer= 2.5 mrad, Divergence= .35 mrad
 NOHD= 10400 meters (34112 feet or 5.6 nautical miles)

Table values are FOOTPRINT dimensions(feet and meters)

ALTITUDE (feet)	FOOTPRINT	SLANT RANGE (nautical miles, feet, and meters)													
		0.8 NM		1.0 NM		1.2 NM		1.4 NM		1.6 NM		1.8 NM		2.0 NM	
		4860 ft	1480 m	6080 ft	1850 m	7290 ft	2220 m	8510 ft	2590 m	9720 ft	2960 m	10900 ft	3330 m	12200 ft	3700 m
5500	FORWARD	-99		18 ft		26 ft		35 ft		46 ft		58 ft		72 ft	
		-99		5 m		8 m		11 m		14 m		18 m		22 m	
	AFT	-99		18 ft		26 ft		35 ft		46 ft		58 ft		71 ft	
		-99		5 m		8 m		11 m		14 m		18 m		22 m	
6000	FORWARD	-99		16 ft		24 ft		32 ft		42 ft		54 ft		66 ft	
		-99		5 m		7 m		10 m		13 m		16 m		20 m	
	AFT	-99		16 ft		24 ft		32 ft		42 ft		53 ft		66 ft	
		-99		5 m		7 m		10 m		13 m		16 m		20 m	
6500	FORWARD	-99		-99		22 ft		30 ft		39 ft		49 ft		61 ft	
		-99		-99		7 m		9 m		12 m		15 m		19 m	
	AFT	-99		-99		22 ft		30 ft		39 ft		49 ft		61 ft	
		-99		-99		7 m		9 m		12 m		15 m		18 m	
7000	FORWARD	-99		-99		20 ft		28 ft		36 ft		46 ft		57 ft	
		-99		-99		6 m		8 m		11 m		14 m		17 m	
	AFT	-99		-99		20 ft		28 ft		36 ft		46 ft		56 ft	
		-99		-99		6 m		8 m		11 m		14 m		17 m	
7500	FORWARD	-99		-99		-99		26 ft		34 ft		43 ft		53 ft	
		-99		-99		-99		8 m		10 m		13 m		16 m	
	AFT	-99		-99		-99		26 ft		34 ft		43 ft		52 ft	
		-99		-99		-99		8 m		10 m		13 m		16 m	
8000	FORWARD	-99		-99		-99		24 ft		32 ft		40 ft		50 ft	
		-99		-99		-99		7 m		10 m		12 m		15 m	
	AFT	-99		-99		-99		24 ft		32 ft		40 ft		49 ft	
		-99		-99		-99		7 m		10 m		12 m		15 m	
8500	FORWARD	-99		-99		-99		23 ft		30 ft		38 ft		47 ft	
		-99		-99		-99		7 m		9 m		11 m		14 m	

	AFT	-99	-99	-99	-99	23 ft 7 m	30 ft 9 m	38 ft 11 m	46 ft 14 m
9000	FORWARD	-99	-99	-99	-99	-99	28 ft 9 m	36 ft 11 m	44 ft 13 m
	AFT	-99	-99	-99	-99	-99	28 ft 9 m	35 ft 11 m	44 ft 13 m
9500	FORWARD	-99	-99	-99	-99	-99	27 ft 8 m	34 ft 10 m	42 ft 13 m
	AFT	-99	-99	-99	-99	-99	27 ft 8 m	34 ft 10 m	41 ft 13 m
10000	FORWARD	-99	-99	-99	-99	-99	-99	32 ft 10 m	40 ft 12 m
	AFT	-99	-99	-99	-99	-99	-99	32 ft 10 m	39 ft 12 m
	WIDTH	-99	-99	33 ft 10 m	39 ft 12 m	46 ft 14 m	52 ft 16 m	59 ft 18 m	65 ft 20 m

FOOTPRINT FORWARD- distance beyond target.

FOOTPRINT AFT- distance from target toward aircraft.

FOOTPRINT WIDTH- total width at target.

NOTE: -99 indicates an impossible alt./range combination

LASER FOOTPRINT TABLE for: PAVE SPIKE

Table based on: Flat terrain, Buffer= 2.5 mrad, Divergence= .35 mrad
 NOHD= 10400 meters (34112 feet or 5.6 nautical miles)

Table values are FOOTPRINT dimensions(feet and meters)

SLANT RANGE (nautical miles, feet, and meters)										
ALTITUDE	FOOTPRINT	0.8 NM	1.0 NM	1.2 NM	1.4 NM	1.6 NM	1.8 NM	2.0 NM		
(feet)		4860 ft	6080 ft	7290 ft	8510 ft	9720 ft	10900 ft	12200 ft		
		1480 m	1850 m	2220 m	2590 m	2960 m	3330 m	3700 m		
10500	FORWARD	-99	-99	-99	-99	-99	-99	30 ft	38 ft	
	AFT	-99	-99	-99	-99	-99	-99	9 m	11 m	
11000	FORWARD	-99	-99	-99	-99	-99	-99	30 ft	38 ft	
	AFT	-99	-99	-99	-99	-99	-99	9 m	11 m	
11500	FORWARD	-99	-99	-99	-99	-99	-99	30 ft	38 ft	
	AFT	-99	-99	-99	-99	-99	-99	9 m	11 m	
12000	FORWARD	-99	-99	-99	-99	-99	-99	30 ft	38 ft	
	AFT	-99	-99	-99	-99	-99	-99	9 m	11 m	
12500	FORWARD	-99	-99	-99	-99	-99	-99	30 ft	38 ft	
	AFT	-99	-99	-99	-99	-99	-99	9 m	11 m	
13000	FORWARD	-99	-99	-99	-99	-99	-99	30 ft	38 ft	
	AFT	-99	-99	-99	-99	-99	-99	9 m	11 m	
13500	FORWARD	-99	-99	-99	-99	-99	-99	30 ft	38 ft	
	AFT	-99	-99	-99	-99	-99	-99	9 m	11 m	

S32.TXT

14000	AFT	-99	-99	-99	-99	-99	-99	-99	-99	-99	-99	-99	-99
		-99	-99	-99	-99	-99	-99	-99	-99	-99	-99	-99	-99
	FORWARD	-99	-99	-99	-99	-99	-99	-99	-99	-99	-99	-99	-99
14500	AFT	-99	-99	-99	-99	-99	-99	-99	-99	-99	-99	-99	-99
		-99	-99	-99	-99	-99	-99	-99	-99	-99	-99	-99	-99
	FORWARD	-99	-99	-99	-99	-99	-99	-99	-99	-99	-99	-99	-99
15000	AFT	-99	-99	-99	-99	-99	-99	-99	-99	-99	-99	-99	-99
		-99	-99	-99	-99	-99	-99	-99	-99	-99	-99	-99	-99
	FORWARD	-99	-99	-99	-99	-99	-99	-99	-99	-99	-99	-99	-99
WIDTH		-99	-99	-99	-99	-99	-99	-99	-99	-99	-99	-99	-99
		-99	-99	-99	-99	-99	-99	-99	-99	-99	-99	-99	-99

 FOOTPRINT FORWARD- distance beyond target.
 FOOTPRINT AFT- distance from target toward aircraft.
 FOOTPRINT WIDTH- total width at target.
 NOTE: -99 indicates an impossible alt./range combination

LASER FOOTPRINT TABLE for: PAVE SPIKE

Table based on: Flat terrain, Buffer= 2.5 mrad, Divergence= .35 mrad
 NOHD= 10400 meters (34112 feet or 5.6 nautical miles)

Table values are FOOTPRINT dimensions(feet and meters)

		SLANT RANGE (nautical miles, feet, and meters)									
ALTITUDE (feet)	FOOTPRINT	0.8 NM	1.0 NM	1.2 NM	1.4 NM	1.6 NM	1.8 NM	2.0 NM			
		4860 ft 1480 m	6080 ft 1850 m	7290 ft 2220 m	8510 ft 2590 m	9720 ft 2960 m	10900 ft 3330 m	12200 ft 3700 m			
15500	FORWARD	-99	-99	-99	-99	-99	-99	-99	-99	-99	-99
	AFT	-99	-99	-99	-99	-99	-99	-99	-99	-99	-99
		-99	-99	-99	-99	-99	-99	-99	-99	-99	-99
		-99	-99	-99	-99	-99	-99	-99	-99	-99	-99
16000	FORWARD	-99	-99	-99	-99	-99	-99	-99	-99	-99	-99
	AFT	-99	-99	-99	-99	-99	-99	-99	-99	-99	-99
		-99	-99	-99	-99	-99	-99	-99	-99	-99	-99
		-99	-99	-99	-99	-99	-99	-99	-99	-99	-99
16500	FORWARD	-99	-99	-99	-99	-99	-99	-99	-99	-99	-99
	AFT	-99	-99	-99	-99	-99	-99	-99	-99	-99	-99
		-99	-99	-99	-99	-99	-99	-99	-99	-99	-99
		-99	-99	-99	-99	-99	-99	-99	-99	-99	-99
17000	FORWARD	-99	-99	-99	-99	-99	-99	-99	-99	-99	-99
	AFT	-99	-99	-99	-99	-99	-99	-99	-99	-99	-99
		-99	-99	-99	-99	-99	-99	-99	-99	-99	-99
		-99	-99	-99	-99	-99	-99	-99	-99	-99	-99
17500	FORWARD	-99	-99	-99	-99	-99	-99	-99	-99	-99	-99
	AFT	-99	-99	-99	-99	-99	-99	-99	-99	-99	-99
		-99	-99	-99	-99	-99	-99	-99	-99	-99	-99
		-99	-99	-99	-99	-99	-99	-99	-99	-99	-99
18000	FORWARD	-99	-99	-99	-99	-99	-99	-99	-99	-99	-99
	AFT	-99	-99	-99	-99	-99	-99	-99	-99	-99	-99
		-99	-99	-99	-99	-99	-99	-99	-99	-99	-99
		-99	-99	-99	-99	-99	-99	-99	-99	-99	-99
18500	FORWARD	-99	-99	-99	-99	-99	-99	-99	-99	-99	-99
		-99	-99	-99	-99	-99	-99	-99	-99	-99	-99

	AFT	-99	-99	-99	-99	-99	-99	-99	-99
		-99	-99	-99	-99	-99	-99	-99	-99
19000	FORWARD	-99	-99	-99	-99	-99	-99	-99	-99
		-99	-99	-99	-99	-99	-99	-99	-99
	AFT	-99	-99	-99	-99	-99	-99	-99	-99
		-99	-99	-99	-99	-99	-99	-99	-99
19500	FORWARD	-99	-99	-99	-99	-99	-99	-99	-99
		-99	-99	-99	-99	-99	-99	-99	-99
	AFT	-99	-99	-99	-99	-99	-99	-99	-99
		-99	-99	-99	-99	-99	-99	-99	-99
20000	FORWARD	-99	-99	-99	-99	-99	-99	-99	-99
		-99	-99	-99	-99	-99	-99	-99	-99
	AFT	-99	-99	-99	-99	-99	-99	-99	-99
		-99	-99	-99	-99	-99	-99	-99	-99
	WIDTH	-99	-99	-99	-99	-99	-99	-99	-99
		-99	-99	-99	-99	-99	-99	-99	-99

 FOOTPRINT FORWARD- distance beyond target.

FOOTPRINT AFT- distance from target toward aircraft.

FOOTPRINT WIDTH- total width at target.

NOTE: -99 indicates an impossible alt./range combination

LASER FOOTPRINT TABLE for: F18 LASER

Table based on: Flat terrain, Buffer= 5 mrad, Divergence= .1 mrad
 NOHD= 17000 meters (55760 feet or 9.2 nautical miles)

Table values are FOOTPRINT dimensions(feet and meters)

ALTITUDE (feet)	FOOTPRINT	SLANT RANGE (nautical miles, feet, and meters)									
		2.0 NM	2.5 NM	3.0 NM	3.5 NM	4.0 NM	4.5 NM	5.0 NM			
		12200 ft 3700 m	15200 ft 4630 m	18200 ft 5560 m	21300 ft 6480 m	24300 ft 7410 m	27300 ft 8330 m	30400 ft 9260 m			
500	FORWARD	1700 ft	2750 ft	4110 ft	5820 ft	7910 ft	10400 ft	13400 ft			
		518 m	839 m	1250 m	1770 m	2410 m	3180 m	4100 m			
	AFT	1330 ft	2020 ft	2830 ft	3760 ft	4790 ft	5920 ft	7130 ft			
		405 m	616 m	864 m	1150 m	1460 m	1800 m	2170 m			
1000	FORWARD	794 ft	1260 ft	1850 ft	2560 ft	3400 ft	4380 ft	5510 ft			
		242 m	385 m	563 m	780 m	1040 m	1330 m	1680 m			
	AFT	703 ft	1080 ft	1540 ft	2060 ft	2660 ft	3320 ft	4040 ft			
		214 m	330 m	468 m	629 m	810 m	1010 m	1230 m			
1500	FORWARD	518 ft	819 ft	1190 ft	1640 ft	2170 ft	2770 ft	3460 ft			
		158 m	249 m	363 m	500 m	660 m	845 m	1050 m			
	AFT	478 ft	739 ft	1050 ft	1420 ft	1840 ft	2310 ft	2820 ft			
		146 m	225 m	321 m	433 m	560 m	703 m	859 m			
2000	FORWARD	385 ft	606 ft	879 ft	1210 ft	1590 ft	2030 ft	2520 ft			
		117 m	185 m	268 m	368 m	484 m	618 m	769 m			
	AFT	362 ft	561 ft	802 ft	1080 ft	1410 ft	1770 ft	2160 ft			
		110 m	171 m	245 m	330 m	428 m	538 m	660 m			
2500	FORWARD	306 ft	481 ft	697 ft	954 ft	1250 ft	1600 ft	1990 ft			
		93 m	147 m	212 m	291 m	382 m	487 m	605 m			
	AFT	291 ft	452 ft	648 ft	876 ft	1140 ft	1430 ft	1760 ft			
		89 m	138 m	197 m	267 m	347 m	436 m	536 m			
3000	FORWARD	254 ft	398 ft	577 ft	789 ft	1040 ft	1320 ft	1640 ft			
		77 m	121 m	176 m	241 m	316 m	402 m	499 m			
	AFT	244 ft	379 ft	543 ft	735 ft	956 ft	1200 ft	1480 ft			
		74 m	115 m	165 m	224 m	291 m	367 m	451 m			
3500	FORWARD	217 ft	340 ft	492 ft	673 ft	883 ft	1120 ft	1390 ft			
		66 m	104 m	150 m	205 m	269 m	342 m	424 m			

F18L.TXT

4000	AFT	210 ft 64 m	326 ft 99 m	467 ft 142 m	633 ft 193 m	824 ft 251 m	1040 ft 316 m	1280 ft 389 m
	FORWARD	189 ft 58 m	297 ft 90 m	429 ft 131 m	586 ft 179 m	769 ft 234 m	977 ft 298 m	1210 ft 369 m
4500	AFT	184 ft 56 m	286 ft 87 m	410 ft 125 m	556 ft 170 m	724 ft 221 m	913 ft 278 m	1120 ft 342 m
	FORWARD	168 ft 51 m	263 ft 80 m	380 ft 116 m	520 ft 158 m	681 ft 208 m	865 ft 264 m	1070 ft 327 m
5000	AFT	164 ft 50 m	255 ft 78 m	366 ft 111 m	496 ft 151 m	646 ft 197 m	814 ft 248 m	1000 ft 305 m
	FORWARD	151 ft 46 m	236 ft 72 m	342 ft 104 m	467 ft 142 m	611 ft 186 m	776 ft 237 m	961 ft 293 m
WIDTH	AFT	148 ft 45 m	230 ft 70 m	330 ft 101 m	447 ft 136 m	583 ft 178 m	735 ft 224 m	905 ft 276 m
	FORWARD	123 ft 37 m	153 ft 47 m	184 ft 56 m	215 ft 65 m	245 ft 75 m	276 ft 84 m	307 ft 94 m

 FOOTPRINT FORWARD- distance beyond target.
 FOOTPRINT AFT- distance from target toward aircraft.
 FOOTPRINT WIDTH- total width at target.
 NOTE: -99 indicates an impossible alt./range combination

Medium

LASER FOOTPRINT TABLE for: F18 LASER

Table based on: Flat terrain, Buffer= 5 mrad, Divergence= .1 mrad
 NOHD= 17000 meters (55760 feet or 9.2 nautical miles)

Table values are FOOTPRINT dimensions(feet and meters)

ALTITUDE (feet)	FOOTPRINT	SLANT RANGE (nautical miles, feet, and meters)							
		1.3 NM 7900 ft 2410 m	1.5 NM 9110 ft 2780 m	1.7 NM 10300 ft 3150 m	1.9 NM 11500 ft 3520 m	2.1 NM 12800 ft 3890 m	2.3 NM 14000 ft 4260 m		
8000	FORWARD	-99	53 ft 16 m	68 ft 21 m	85 ft 26 m	103 ft 32 m	124 ft 38 m		
	AFT	-99	52 ft 16 m	67 ft 20 m	84 ft 26 m	102 ft 31 m	122 ft 37 m		
	FORWARD	-99	47 ft 14 m	60 ft 18 m	75 ft 23 m	92 ft 28 m	110 ft 34 m		
	AFT	-99	47 ft 14 m	60 ft 18 m	74 ft 23 m	91 ft 28 m	109 ft 33 m		
10000	FORWARD	-99	-99	54 ft 16 m	68 ft 21 m	83 ft 25 m	99 ft 30 m		
	AFT	-99	-99	54 ft 16 m	67 ft 20 m	82 ft 25 m	98 ft 30 m		
	FORWARD	-99	-99	-99	61 ft 19 m	75 ft 23 m	90 ft 27 m		
	AFT	-99	-99	-99	61 ft 19 m	75 ft 23 m	89 ft 27 m		
12000	FORWARD	-99	-99	-99	-99	69 ft 21 m	82 ft 25 m		
	AFT	-99	-99	-99	-99	68 ft 21 m	82 ft 25 m		
	FORWARD	-99	-99	-99	-99	-99	76 ft 23 m		
	AFT	-99	-99	-99	-99	-99	76 ft 23 m		
13000	FORWARD	-99	-99	-99	-99	-99	-99		
	AFT	-99	-99	-99	-99	-99	-99		
	FORWARD	-99	-99	-99	-99	-99	-99		
	AFT	-99	-99	-99	-99	-99	-99		
14000	FORWARD	-99	-99	-99	-99	-99	-99		
	AFT	-99	-99	-99	-99	-99	-99		
	FORWARD	-99	-99	-99	-99	-99	-99		
	AFT	-99	-99	-99	-99	-99	-99		

F18M.TXT

15000	AFT	-99	-99	-99	-99	-99	-99	-99	-99
		-99	-99	-99	-99	-99	-99	-99	-99
	FORWARD	-99	-99	-99	-99	-99	-99	-99	-99
16000	AFT	-99	-99	-99	-99	-99	-99	-99	-99
		-99	-99	-99	-99	-99	-99	-99	-99
	FORWARD	-99	-99	-99	-99	-99	-99	-99	-99
17000	AFT	-99	-99	-99	-99	-99	-99	-99	-99
		-99	-99	-99	-99	-99	-99	-99	-99
	FORWARD	-99	-99	-99	-99	-99	-99	-99	-99
WIDTH		-99	-99	-99	-99	-99	-99	-99	-99
		-99	-99	-99	-99	-99	-99	-99	-99
		-99	-99	-99	-99	-99	-99	-99	-99

FOOTPRINT FORWARD- distance beyond target.
 FOOTPRINT AFT- distance from target toward aircraft.
 FOOTPRINT WIDTH- total width at target.
 NOTE: -99 indicates an impossible alt./range combination

Buddy Lane

LASER FOOTPRINT TABLE for: F18 LASER

Table based on: Flat terrain, Buffer= 5 mrad, Divergence= .1 mrad
 NOHD= 17000 meters (55760 feet or 9.2 nautical miles)

Table values are FOOTPRINT dimensions(feet and meters)

ALTITUDE (feet)	FOOTPRINT	SLANT RANGE (nautical miles, feet, and meters)									
		0.8 NM	1.0 NM	1.2 NM	1.4 NM	1.6 NM	1.8 NM	2.0 NM			
500		4860 ft	6080 ft	7290 ft	8510 ft	9720 ft	10900 ft	12200 ft			
		1480 m	1850 m	2220 m	2590 m	2960 m	3330 m	3700 m			
	FORWARD	251 ft	397 ft	580 ft	799 ft	1060 ft	1360 ft	1700 ft			
	AFT	76 m	121 m	177 m	244 m	323 m	414 m	518 m			
1000		228 ft	351 ft	500 ft	673 ft	869 ft	1090 ft	1330 ft			
		69 m	107 m	152 m	205 m	265 m	332 m	405 m			
	FORWARD	122 ft	192 ft	279 ft	382 ft	502 ft	639 ft	794 ft			
	AFT	37 m	59 m	85 m	116 m	153 m	195 m	242 m			
1500		117 ft	181 ft	259 ft	350 ft	455 ft	573 ft	703 ft			
		36 m	55 m	79 m	107 m	139 m	175 m	214 m			
	FORWARD	81 ft	127 ft	183 ft	251 ft	329 ft	418 ft	518 ft			
	AFT	25 m	39 m	56 m	76 m	100 m	127 m	158 m			
2000		78 ft	122 ft	175 ft	237 ft	308 ft	389 ft	478 ft			
		24 m	37 m	53 m	72 m	94 m	118 m	146 m			
	FORWARD	60 ft	95 ft	137 ft	187 ft	245 ft	310 ft	385 ft			
	AFT	18 m	29 m	42 m	57 m	75 m	95 m	117 m			
2500		59 ft	92 ft	132 ft	179 ft	233 ft	294 ft	362 ft			
		18 m	28 m	40 m	55 m	71 m	90 m	110 m			
	FORWARD	48 ft	75 ft	109 ft	149 ft	195 ft	247 ft	306 ft			
	AFT	15 m	23 m	33 m	45 m	59 m	75 m	93 m			
3000		47 ft	74 ft	106 ft	144 ft	187 ft	237 ft	291 ft			
		14 m	22 m	32 m	44 m	57 m	72 m	89 m			
	FORWARD	40 ft	63 ft	91 ft	123 ft	162 ft	205 ft	254 ft			
	AFT	12 m	19 m	28 m	38 m	49 m	62 m	77 m			
3500		40 ft	62 ft	89 ft	120 ft	157 ft	198 ft	244 ft			
		12 m	19 m	27 m	37 m	48 m	60 m	74 m			
	FORWARD	34 ft	54 ft	77 ft	106 ft	138 ft	175 ft	217 ft			
	AFT	10 m	16 m	24 m	32 m	42 m	53 m	66 m			

F18B.TXT

4000	AFT	34 ft 10 m	53 ft 16 m	76 ft 23 m	103 ft 31 m	135 ft 41 m	170 ft 52 m	210 ft 64 m
	FORWARD	30 ft 9 m	47 ft 14 m	68 ft 21 m	92 ft 28 m	121 ft 37 m	153 ft 47 m	189 ft 58 m
	AFT	30 ft 9 m	46 ft 14 m	67 ft 20 m	90 ft 28 m	118 ft 36 m	149 ft 45 m	184 ft 56 m
	FORWARD	27 ft 8 m	42 ft 13 m	60 ft 18 m	82 ft 25 m	107 ft 33 m	136 ft 41 m	168 ft 51 m
	AFT	26 ft 8 m	41 ft 13 m	59 ft 18 m	81 ft 25 m	105 ft 32 m	133 ft 40 m	164 ft 50 m
5000	FORWARD	-99	37 ft 11 m	54 ft 16 m	74 ft 22 m	96 ft 29 m	122 ft 37 m	151 ft 46 m
	AFT	-99	37 ft 11 m	53 ft 16 m	73 ft 22 m	95 ft 29 m	120 ft 36 m	148 ft 45 m
	WIDTH	49 ft 15 m	61 ft 19 m	74 ft 22 m	86 ft 26 m	98 ft 30 m	110 ft 34 m	123 ft 37 m

FOOTPRINT FORWARD- distance beyond target.

FOOTPRINT AFT- distance from target toward aircraft.

FOOTPRINT WIDTH- total width at target.

NOTE: -99 indicates an impossible alt./range combination

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LASER FOOTPRINT TABLE for: TRAM

Table based on: Flat terrain, Buffer= 5 mrad, Divergence= .1 mrad
 NOHD= 14600 meters (47888 feet or 7.9 nautical miles)

Left

Table values are FOOTPRINT dimensions(feet and meters)

		SLANT RANGE (nautical miles, feet, and meters)									
ALTITUDE (feet)	FOOTPRINT	2.0 NM	2.5 NM	3.0 NM	3.5 NM	4.0 NM	4.5 NM	5.0 NM			
		12200 ft 3700 m	15200 ft 4630 m	18200 ft 5560 m	21300 ft 6480 m	24300 ft 7410 m	27300 ft 8330 m	30400 ft 9260 m			
500	FORWARD	1700 ft	2750 ft	4110 ft	5820 ft	7910 ft	10400 ft	13400 ft.			
	AFT	518 m	839 m	1250 m	1770 m	2410 m	3180 m	4100 m			
1000	FORWARD	1330 ft	2020 ft	2830 ft	3760 ft	4790 ft	5920 ft	7130 ft			
	AFT	405 m	616 m	864 m	1150 m	1460 m	1800 m	2170 m			
1500	FORWARD	794 ft	1260 ft	1850 ft	2560 ft	3400 ft	4380 ft	5510 ft			
	AFT	242 m	385 m	563 m	780 m	1040 m	1330 m	1680 m			
2000	FORWARD	703 ft	1080 ft	1540 ft	2060 ft	2660 ft	3320 ft	4040 ft			
	AFT	214 m	330 m	468 m	629 m	810 m	1010 m	1230 m			
2500	FORWARD	518 ft	819 ft	1190 ft	1640 ft	2170 ft	2770 ft	3460 ft			
	AFT	158 m	249 m	363 m	500 m	660 m	845 m	1050 m			
3000	FORWARD	478 ft	739 ft	1050 ft	1420 ft	1840 ft	2310 ft	2820 ft			
	AFT	146 m	225 m	321 m	433 m	560 m	703 m	859 m			
3500	FORWARD	385 ft	606 ft	879 ft	1210 ft	1590 ft	2030 ft	2520 ft			
	AFT	117 m	185 m	268 m	368 m	484 m	618 m	769 m			
4000	FORWARD	362 ft	561 ft	802 ft	1080 ft	1410 ft	1770 ft	2160 ft			
	AFT	110 m	171 m	245 m	330 m	428 m	538 m	660 m			
4500	FORWARD	306 ft	481 ft	697 ft	954 ft	1250 ft	1600 ft	1990 ft			
	AFT	93 m	147 m	212 m	291 m	382 m	487 m	605 m			
5000	FORWARD	291 ft	452 ft	648 ft	876 ft	1140 ft	1430 ft	1760 ft			
	AFT	89 m	138 m	197 m	267 m	347 m	436 m	536 m			
5500	FORWARD	254 ft	398 ft	577 ft	789 ft	1040 ft	1320 ft	1640 ft			
	AFT	77 m	121 m	176 m	241 m	316 m	402 m	499 m			
6000	FORWARD	244 ft	379 ft	543 ft	735 ft	956 ft	1200 ft	1480 ft			
	AFT	74 m	115 m	165 m	224 m	291 m	367 m	451 m			
6500	FORWARD	217 ft	340 ft	492 ft	673 ft	883 ft	1120 ft	1390 ft			
	AFT	66 m	104 m	150 m	205 m	269 m	342 m	424 m			

4000	AFT	210 ft 64 m	326 ft 99 m	467 ft 142 m	633 ft 193 m	824 ft 251 m	1040 ft 316 m	1280 ft 389 m
	FORWARD	189 ft 58 m	297 ft 90 m	429 ft 131 m	586 ft 179 m	769 ft 234 m	977 ft 298 m	1210 ft 369 m
	AFT	184 ft 56 m	286 ft 87 m	410 ft 125 m	556 ft 170 m	724 ft 221 m	913 ft 278 m	1120 ft 342 m
4500	FORWARD	168 ft 51 m	263 ft 80 m	380 ft 116 m	520 ft 158 m	681 ft 208 m	865 ft 264 m	1070 ft 327 m
	AFT	164 ft 50 m	255 ft 78 m	366 ft 111 m	496 ft 151 m	646 ft 197 m	814 ft 248 m	1000 ft 305 m
	FORWARD	151 ft 46 m	236 ft 72 m	342 ft 104 m	467 ft 142 m	611 ft 186 m	776 ft 237 m	961 ft 293 m
5000	AFT	148 ft 45 m	230 ft 70 m	330 ft 101 m	447 ft 136 m	583 ft 178 m	735 ft 224 m	905 ft 275 m
	WIDTH	123 ft 37 m	153 ft 47 m	184 ft 56 m	215 ft 65 m	245 ft 75 m	276 ft 84 m	307 ft 94 m

FOOTPRINT FORWARD- distance beyond target.

FOOTPRINT AFT- distance from target toward aircraft.

FOOTPRINT WIDTH- total width at target.

NOTE: -99 indicates an impossible alt./range combination

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LASER FOOTPRINT TABLE for: TRAM

Table based on: Flat terrain, Buffer= 5 mrad, Divergence= .1 mrad
 NOHD= 14600 meters (47888 feet or 7.9 nautical miles)

Medium

Table values are FOOTPRINT dimensions(feet and meters)

ALTITUDE (feet)	FOOTPRINT	SLANT RANGE (nautical miles, feet, and meters)							
		1.3 NM 7900 ft 2410 m	1.5 NM 9110 ft 2780 m	1.7 NM 10300 ft 3150 m	1.9 NM 11500 ft 3520 m	2.1 NM 12800 ft 3890 m	2.3 NM 14000 ft 4260 m		
8000	FORWARD	-99	53 ft 16 m	68 ft 21 m	85 ft 26 m	103 ft 32 m	124 ft 38 m		
	AFT	-99	52 ft 16 m	67 ft 20 m	84 ft 26 m	102 ft 31 m	122 ft 37 m		
9000	FORWARD	-99	47 ft 14 m	60 ft 18 m	75 ft 23 m	92 ft 28 m	110 ft 34 m		
	AFT	-99	47 ft 14 m	60 ft 18 m	74 ft 23 m	91 ft 28 m	109 ft 33 m		
10000	FORWARD	-99	-99	54 ft 16 m	68 ft 21 m	83 ft 25 m	99 ft 30 m		
	AFT	-99	-99	54 ft 16 m	67 ft 20 m	82 ft 25 m	98 ft 30 m		
11000	FORWARD	-99	-99	-99	61 ft 19 m	75 ft 23 m	90 ft 27 m		
	AFT	-99	-99	-99	61 ft 19 m	75 ft 23 m	89 ft 27 m		
12000	FORWARD	-99	-99	-99	-99	69 ft 21 m	82 ft 25 m		
	AFT	-99	-99	-99	-99	68 ft 21 m	82 ft 25 m		
13000	FORWARD	-99	-99	-99	-99	-99	76 ft 23 m		
	AFT	-99	-99	-99	-99	-99	76 ft 23 m		
14000	FORWARD	-99	-99	-99	-99	-99	-99		
	AFT	-99	-99	-99	-99	-99	-99		

TRAM2.TXT

15000	AFT	-99	-99	-99	-99	-99	-99	-99	-99	-99	-99	-99
		-99	-99	-99	-99	-99	-99	-99	-99	-99	-99	-99
	FORWARD	-99	-99	-99	-99	-99	-99	-99	-99	-99	-99	-99
16000	AFT	-99	-99	-99	-99	-99	-99	-99	-99	-99	-99	-99
		-99	-99	-99	-99	-99	-99	-99	-99	-99	-99	-99
	FORWARD	-99	-99	-99	-99	-99	-99	-99	-99	-99	-99	-99
17000	AFT	-99	-99	-99	-99	-99	-99	-99	-99	-99	-99	-99
		-99	-99	-99	-99	-99	-99	-99	-99	-99	-99	-99
	FORWARD	-99	-99	-99	-99	-99	-99	-99	-99	-99	-99	-99
WIDTH		-99	-99	92 ft	104 ft	117 ft	129 ft	141 ft				
		-99	-99	28 m	32 m	36 m	39 m	43 m				

 FOOTPRINT FORWARD- distance beyond target.
 FOOTPRINT AFT- distance from target toward aircraft.
 FOOTPRINT WIDTH- total width at target.
 NOTE: -99 indicates an impossible alt./range combination

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Buddy Lane

LASER FOOTPRINT TABLE for: TRAM

Table based on: Flat terrain, Buffer= 5 mrad, Divergence= .1 mrad
 NOHD= 14600 meters (47888 feet or 7.9 nautical miles)

Table values are FOOTPRINT dimensions(feet and meters)

ALTITUDE (feet)	FOOTPRINT	SLANT RANGE (nautical miles, feet, and meters)							
		0.8 NM	1.0 NM	1.2 NM	1.4 NM	1.6 NM	1.8 NM	2.0 NM	
500		4860 ft	6080 ft	7290 ft	8510 ft	9720 ft	10900 ft	12200 ft	
		1480 m	1850 m	2220 m	2590 m	2960 m	3330 m	3700 m	
1000	FORWARD	251 ft	397 ft	580 ft	799 ft	1060 ft	1360 ft	1700 ft	
		76 m	121 m	177 m	244 m	323 m	414 m	518 m	
1500	AFT	228 ft	351 ft	500 ft	673 ft	869 ft	1090 ft	1330 ft	
		69 m	107 m	152 m	205 m	265 m	332 m	405 m	
2000	FORWARD	122 ft	192 ft	279 ft	382 ft	502 ft	639 ft	794 ft	
		37 m	59 m	85 m	116 m	153 m	195 m	242 m	
2500	AFT	117 ft	181 ft	259 ft	350 ft	455 ft	573 ft	703 ft	
		36 m	55 m	79 m	107 m	139 m	175 m	214 m	
3000	FORWARD	81 ft	127 ft	183 ft	251 ft	329 ft	418 ft	518 ft	
		25 m	39 m	56 m	76 m	100 m	127 m	158 m	
3500	AFT	78 ft	122 ft	175 ft	237 ft	308 ft	389 ft	478 ft	
		24 m	37 m	53 m	72 m	94 m	118 m	146 m	
4000	FORWARD	60 ft	95 ft	137 ft	187 ft	245 ft	310 ft	385 ft	
		18 m	29 m	42 m	57 m	75 m	95 m	117 m	
4500	AFT	59 ft	92 ft	132 ft	179 ft	233 ft	294 ft	362 ft	
		18 m	28 m	40 m	55 m	71 m	90 m	110 m	
5000	FORWARD	48 ft	75 ft	109 ft	149 ft	195 ft	247 ft	306 ft	
		15 m	23 m	33 m	45 m	59 m	75 m	93 m	
5500	AFT	47 ft	74 ft	106 ft	144 ft	187 ft	237 ft	291 ft	
		14 m	22 m	32 m	44 m	57 m	72 m	89 m	
6000	FORWARD	40 ft	63 ft	91 ft	123 ft	162 ft	205 ft	254 ft	
		12 m	19 m	28 m	38 m	49 m	62 m	77 m	
6500	AFT	40 ft	62 ft	89 ft	120 ft	157 ft	198 ft	244 ft	
		12 m	19 m	27 m	37 m	48 m	60 m	74 m	
7000	FORWARD	34 ft	54 ft	77 ft	106 ft	138 ft	175 ft	217 ft	
		10 m	16 m	24 m	32 m	42 m	53 m	66 m	

TRAM3.TXT

AFT	34 ft 10 m	53 ft 16 m	76 ft 23 m	103 ft 31 m	135 ft 41 m	170 ft 52 m	210 ft 64 m
4000							
FORWARD	30 ft 9 m	47 ft 14 m	68 ft 21 m	92 ft 28 m	121 ft 37 m	153 ft 47 m	189 ft 58 m
AFT	30 ft 9 m	46 ft 14 m	67 ft 20 m	90 ft 28 m	118 ft 36 m	149 ft 45 m	184 ft 56 m
4500							
FORWARD	27 ft 8 m	42 ft 13 m	60 ft 18 m	82 ft 25 m	107 ft 33 m	136 ft 41 m	168 ft 51 m
AFT	26 ft 8 m	41 ft 13 m	59 ft 18 m	81 ft 25 m	105 ft 32 m	133 ft 40 m	164 ft 50 m
5000							
FORWARD	-99	37 ft 11 m	54 ft 16 m	74 ft 22 m	96 ft 29 m	122 ft 37 m	151 ft 46 m
AFT	-99	37 ft 11 m	53 ft 16 m	73 ft 22 m	95 ft 29 m	120 ft 36 m	148 ft 45 m
WIDTH	49 ft 15 m	61 ft 19 m	74 ft 22 m	86 ft 26 m	98 ft 30 m	110 ft 34 m	123 ft 37 m

FOOTPRINT FORWARD- distance beyond target.

FOOTPRINT AFT- distance from target toward aircraft.

FOOTPRINT WIDTH- total width at target.

NOTE: -99 indicates an impossible alt./range combination

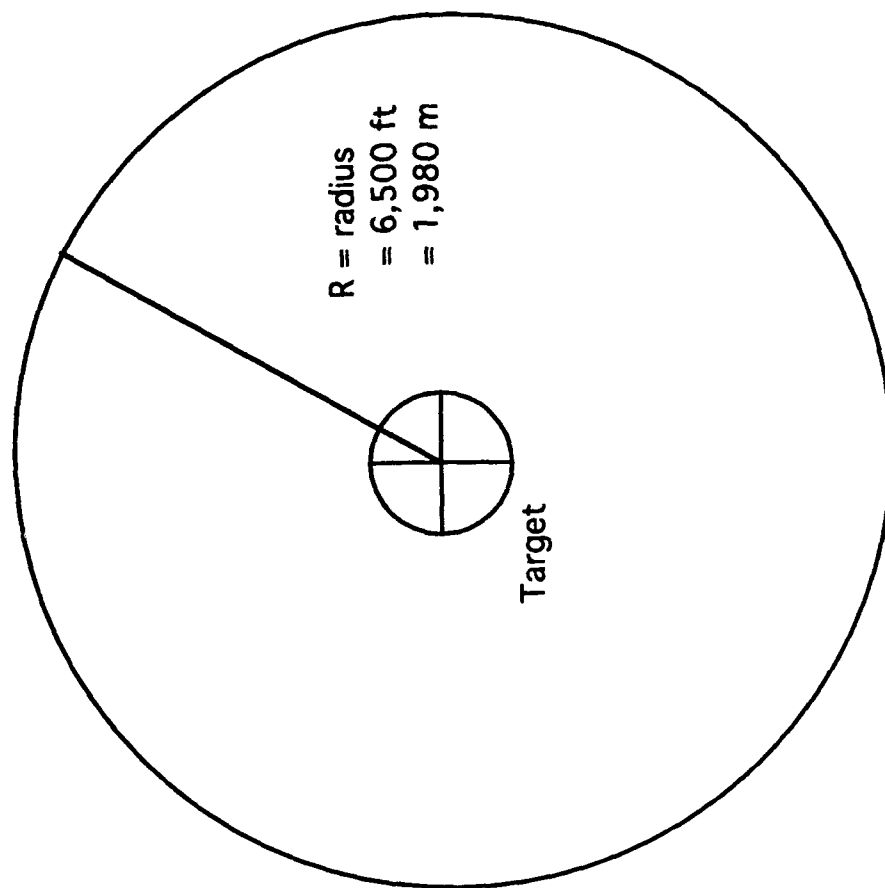
APPENDIX F

Laser Surface Danger Zones (LSDZs)

Graph 1

LSDZ FOR THE TACTICAL RANGES TARGETS

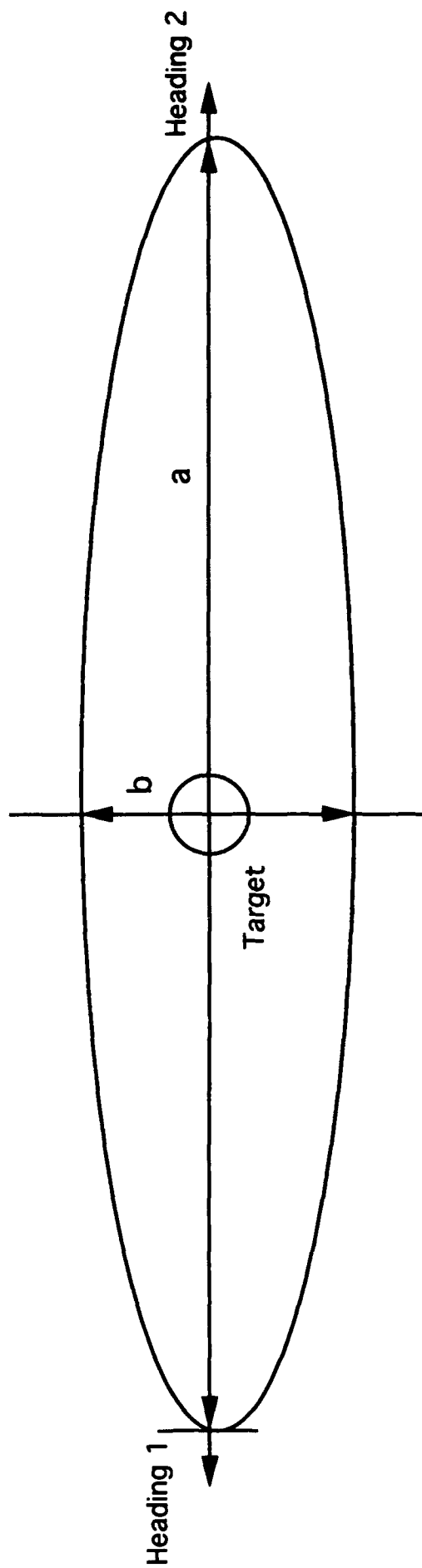
(any possible heading)



Graph 2

LSDZ FOR THE MANNED RANGES TARGETS

(2 possible headings)

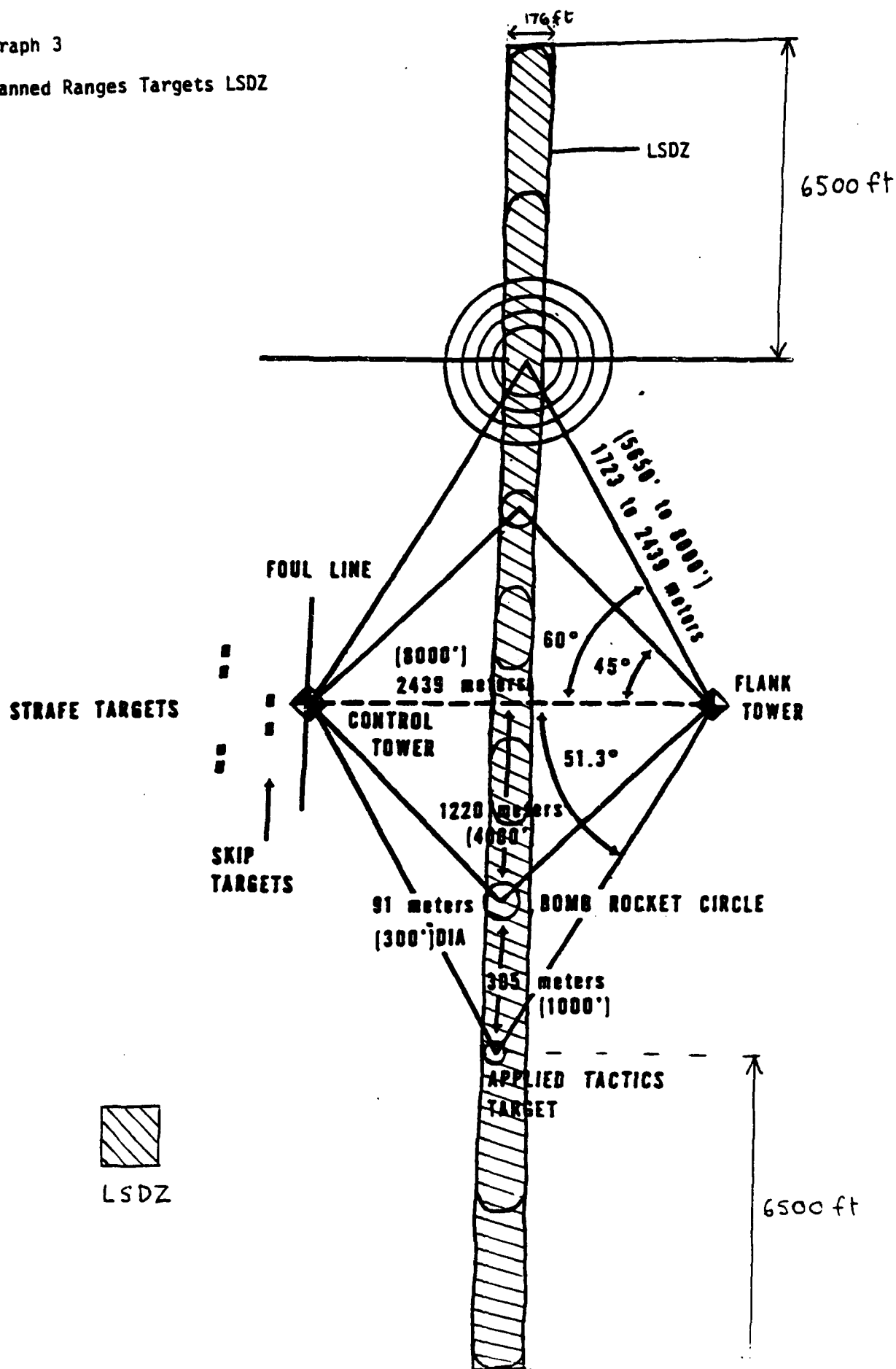


$$\left\{ \begin{array}{l} a = 13,000 \text{ ft} \\ \quad = 3,960 \text{ m} \end{array} \right.$$

$$\left\{ \begin{array}{l} b = 176 \text{ ft} \\ \quad = 54 \text{ m} \end{array} \right.$$

Graph 3

Manned Ranges Targets LSDZ



APPENDIX G
Medical Surveillance

the organization requiring access, such as a service organization. However, there shall be a designated LSO for all circumstances of operations of a laser or laser system above Class 2. Specific minimum duties of the LSO are detailed in 1.3.2.

(2) Education of authorized personnel (LSOs, operators, service personnel and others) in the assessment and control of laser hazards. This may be accomplished through training programs.

(3) Application of adequate protective measures for the control of laser hazards as required in Section 4.

(4) Incident investigation, including reporting of alleged accidents, and preparation of action plans for the future prevention of accidents following a known or suspected incident. (See reference [7] in D7 for Federal reporting requirements.)

(5) Provide an appropriate medical surveillance program in accordance with Section 6.

A guide for the organization of a laser safety program is outlined in Appendix D.

5.2 Education. The management shall provide training to the LSO on the potential hazards (including bioeffects), control measures, applicable standards, medical surveillance (if applicable) and other pertinent information pertaining to laser safety or provide to the LSO adequate consultative services. The training shall be commensurate to at least the highest class of laser under the jurisdiction of the LSO. Safety training program(s) shall be provided to the users of Class 3b or Class 4 lasers and laser systems, and should be provided to the users of Class 2 and Class 3a lasers and laser systems. Users shall include operators, technicians, engineers, maintenance and service personnel, etc., working with or around lasers. The training shall ensure that the users are knowledgeable of the potential hazards and the control measures for laser equipment they may have occasion to use. The need to train users of Class 2 lasers is not so much a need to instruct on the safe use of the laser, but rather to educate against the misuse of the laser. Curiosity and lack of knowledge can lead to increased risks of misuse of Class 2 lasers.

Where applicable, training shall include electrical safety and cardiopulmonary resuscitation (CPR).

A guide for the organization of a training program is outlined in D6.

5.3 Implementation. The management shall provide adequate supervision, personnel training, facilities, equipment and supplies to control potential hazards of laser and laser systems.

6. Medical Surveillance

6.1 General. The rationale for medical surveillance requirements for personnel working in a laser environment and specific information of value to examining or attending physicians are included in Appendix E. Medical surveillance requirements have been limited to those that are clearly indicated, based on known risks of particular kinds of laser radiation. Medical surveillance is not required for personnel using Class 1, Class 2, Class 2a or Class 3a lasers and laser systems as defined in 3.3.3.2, and shall be required for Class 3b and Class 4 lasers and laser systems. Some employers may wish to provide their employees with additional examinations for medical-legal reasons, to conform with established principles of what constitutes a thorough ophthalmologic or dermatologic examination, or as part of a planned epidemiologic study. Further information is provided in Appendix E.

6.2 Personnel Categories. Each employee's category shall be determined by the LSO in charge of the installation involved. The individuals who should be under laser medical surveillance are defined in 6.2.1 and 6.2.2.

6.2.1 Incidental Personnel. Incidental personnel are those whose work makes it possible (but unlikely) that they will be exposed to laser energy sufficient to damage their eyes or skin, e.g., custodial, military personnel on maneuvers, clerical, and supervisory personnel not working directly with laser devices.

6.2.2 Laser Personnel. Laser personnel are those who work routinely in laser environments. These individuals are ordinarily fully protected by engineering controls or administrative procedures, or both.

6.3 General Procedures

6.3.1 Incidental personnel shall have an eye examination for visual acuity (see Appendix E for further details).

6.3.2 Laser personnel shall be subject to the following baseline eye examination:

Ocular history (E2.2.1). If the ocular history shows no problems and visual acuity (E2.2.2) is found to be 20/20 (6/6 in each eye for far, and Jaeger 1+ for near) with corrections (whether worn or not), and Amsler Grid Test (E2.2.3) and Color Vision (E2.2.4) responses are normal, no further examination is required. Laser workers with medical conditions noted in E2.2.1 should be evaluated carefully with respect to the potential for chronic exposure to laser radiation. Any deviations from acceptable performance will require an identification of the underlying pathology either by a funduscopic examination (E2.2.5), or other tests as determined appropriate by the responsible medical or optometric examiner.

6.4 Frequency of Medical Examinations. For both incidental and laser personnel, required examinations shall be performed prior to participation in laser work. Following any suspected laser injury, the pertinent required examinations will be repeated, in addition to whatever other examinations may be desired by the attending physician. Periodic examinations are not required.

7. Non-Beam Hazards

7.1 General. In addition to direct hazards to the eyes and skin associated with exposure to the laser beam, it is also important to address other hazards associated with the use of lasers, *i.e.*, non-beam hazards. The non-beam hazards, in some cases, can be life threatening, *e.g.*, electrocution. As a result, the special considerations discussed in this section require use of control measures different from those discussed in Section 4. Because of the diversity of these potential hazards, the LSO may employ safety and/or industrial hygiene personnel to effect the hazard evaluations for special considerations. Appendix F provides additional background material on safety and industrial hygiene to aid in the control of these hazards.

NOTE: References useful in evaluating non-beam hazards covered in 7.1 through 7.12 may be found in Appendix F.

7.2 Electrical Hazards. The use of lasers or laser systems can present an electric shock hazard. This may occur from contact with exposed utility power utilization, device control, and power supply conductors operating at potentials of 50 volts and above. These exposures can occur during laser set-up or installation, maintenance and service, where equipment

protective covers are often removed to allow access to active components as required for those activities. Those exposed can be equipment installers, users, technicians, and uninformed members of the public, such as passers by.

The effect upon those who accidentally come into contact with energized conductors at or above 50 volts can range from a minor "tingle", to startle reaction, to serious personal injury, or death. Because the pathways of current are all pervasive, such as ground, it is not possible to characterize all the parameters in any situation to predict the occurrence or outcome of an electric shock accident. Electric shock is a very serious opportunistic hazard, and deaths associated with laser systems have occurred.

Protection against accidental contact with energized conductors by means of a barrier system is the primary methodology to prevent electric shock accidents with laser equipment. Hazard warnings and safety instructions extend the safety system to embody exposures caused by conditions of use, maintenance, and service, and provide protection against the hazards of possible equipment misuse. The utilization of recognized independent testing organizations who verify the efficacy of equipment safety systems with respect to the requirements of consensus safety standards, is important for the protection of the equipment user.

Additional electrical safety requirements are imposed upon laser devices, systems, and those who work with them, by the United States Department of Labor, Occupational Safety and Health Administration (OSHA), the National Electrical Code (NFPA 70), and related state and local laws and regulations. These requirements govern equipment connection to the electrical utilization system, electrical protection parameters, and specific safety training. These requirements must be observed with all laser installations. The following potential problems have frequently been identified during laser facility audits.

- (1) Uncovered electrical terminals
- (2) Improperly insulated electrical terminals
- (3) Hidden "power-up" warning lights
- (4) Lack of personnel trained in current cardiopulmonary resuscitation practices, or lack of refresher training (see 5.2)
- (5) "Buddy system" not being practiced during maintenance and service

Appendix E

Medical Surveillance

E1. Purpose of Medical Surveillance

The basic reasons for performing medical surveillance of personnel working in a laser environment are the same as for other potential health hazards. Medical surveillance examinations may include assessment of physical fitness to safely perform assigned duties, biological monitoring of exposure to a specific agent, and early detection of biologic damage or effect.

Physical fitness assessments are used to determine whether an employee would be at increased or unusual risk in a particular environment. For workers using laser devices, the need for this type of assessment is most likely to be determined by factors other than laser radiation per se. Specific information on medical surveillance requirements that might exist because of other potential exposures, such as toxic gases, noise, ionizing radiation, etc., are outside the scope of this appendix.

Direct biological monitoring of laser radiation is impossible, and practical indirect monitoring through the use of personal dosimeters is not available.

Early detection of biologic change or damage presupposes that chronic or subacute effects may result from exposure to a particular agent at levels below that required to produce acute injury. Active intervention must then be possible to arrest further biological damage or to allow recovery from biological effects. Although chronic injury from laser radiation in the ultraviolet, near ultraviolet, blue portion of the visible, and near infrared regions appears to be theoretically possible, risks to workers using laser devices are primarily from accidental acute injuries. Based on risks involved with current uses of laser devices, medical surveillance requirements that should be incorporated into a formal standard appear to be minimal.

Other arguments in favor of performing extensive medical surveillance have been based on the fear that repeated accidents might occur and the workers would not report minimal acute injuries. The limited number of laser injuries that have been reported in the past 20 years and the excellent safety records with laser devices do not provide support to this argument.

E2. Medical Examinations

E2.1 Rationale for Examinations

E2.1.1 Preassignment Medical Examinations. Except for examination following suspected injury, these are the only examinations required by this standard. One purpose is to establish a baseline against which damage (primarily ocular) can be measured in the event of an accidental injury. A second purpose is to identify certain workers who might be at special risk from chronic exposure to selected continuous-wave lasers. For incidental workers (e.g., custodial, military personnel on maneuvers, clerical and supervisory personnel not working directly with lasers) only visual acuity measurement is required. For laser workers' medical histories, visual acuity measurement, and selected examination protocols are required. The wavelength of laser radiation is the determinant of which specific protocols are required (see E2.2). Examinations should be performed by, or under the supervision of, an ophthalmologist or optometrist or other qualified physician. Certain of the examination protocols may be performed by other qualified practitioners or technicians under the supervision of a physician. Although chronic skin damage from laser radiation has not been reported, and indeed seems unlikely, this area has not been adequately studied. Limited skin examinations are suggested to serve as a baseline until future epidemiologic studies indicates whether they are needed or not.

E2.1.2 Periodic Medical Examinations.

Periodic examinations are not required by this standard. At present no chronic health problems have been linked to working with lasers. Also, most uses of lasers do not result in chronic exposure of employees even to low levels of radiation. A large number of these examinations have been performed in the past, and no indication of any detectable biologic change was noted. Employers may wish to offer their employees periodic eye examinations or other medical examinations as a health benefit; however, there does not appear to be any valid reason to require such examinations as part of a medical surveillance program.

E2.1.3 Termination Medical Examinations.

The primary purpose of termination examinations is for the legal protection of the employer against unwarranted claims for damage that might occur after an employee leaves a particular job. The decision on whether to offer or require such examinations is left to individual employers.

E2.2 Examination Protocols

E2.2.1 Ocular History. The past eye history and family history are reviewed. Any current complaints concerned with the eyes are noted. Inquiry should be made into the general health status with a special emphasis upon systemic diseases which might produce ocular problems in regard to the performance cited in Section 6.1. The current refraction prescription and the date of the most recent examination should be recorded.

Certain medical conditions may cause the laser worker to be at an increased risk for chronic exposure. Use of photosensitizing medications, such as phenothiazines and psoralens, lower the threshold for biological effects in the skin, cornea, lens and retina of experimental animals exposed to ultraviolet and near ultraviolet radiation. (See Table E1 for a representative list of photosensitizing agents.) Aphakic individuals would be subject to additional retinal exposure from blue light and near ultraviolet and ultraviolet radiation. Unless chronic viewing of these wavelengths is required, there should be no reason to deny employment to these individuals.

E2.2.2 Visual Acuity. Visual acuity for far and near vision should be measured with some standardized and reproducible method. Refraction corrections should be made if required for both distant and near test targets. If refractive corrections are not sufficient to change acuity to 20/20 (6/6) for distance, and Jaeger 1+ for near, a more extensive examination is indicated as defined in 6.3.

E2.2.3 Macular Function. An Amsler grid or similar pattern is used to test macular function for distortions and scotomas. The test should be administered in a fashion to minimize malingering and false negatives. If any distortions or missing portions of the grid pattern are present, the test is not normal.

E2.2.4 Color Vision Color vision discrimination can be documented by Ishihara or similar color vision tests.

E2.2.5 Examination of the Ocular Fundus with an Ophthalmoscope This portion of the examination is to be administered to individuals whose ocular function in any of Sections E.2.2.1 through E.2.2.4 is not normal. The points to be covered are: the presence or absence of opacities in the media; the sharpness of outline of the optic disc; the color of the optic disc; the depth of the physiological cup, if present; the ratio of the size of the retinal veins to that of the retinal arteries; the presence or absence of a well-defined macula and the presence or absence of a foveal reflex; and any retinal pathology that can be seen with an ophthalmoscope (hyper-pigmentation, depigmentation, retinal degeneration, exudate, as well as any induced pathology associated with changes in macular function). Even small deviations from normal should be described and carefully localized. Dilation of the pupil is required.

E2.2.6 Skin Examination. Not required for pre-placement examinations of laser workers; however, suggested for employees with history of photosensitivity or working with ultraviolet lasers. Any previous dermatological abnormalities and family history are reviewed. Any current complaints concerned with the skin are noted as well as the history of medication usage, particularly concentrating on those drugs which are potentially photosensitizing.

Further examination should be based on the type of laser radiation, above the appropriate MPE levels, present in the individual's work environment.

E2.2.7 Other Examinations. Further examinations should be done as deemed necessary by the examiner.

E3. Medical Referral Following Suspected or Known Laser Injury

Any employee with a suspected eye injury should be referred to an ophthalmologist. Employees with skin injuries should be seen by a physician.

E4. Records and Record Retention

Complete and accurate records of all medical examinations (including specific test results) should be maintained for all personnel included in the medical surveillance program. Records should be retained for at least 30 years.

E5. Access To Records

The results of medical surveillance examinations should be discussed with the employee.

All non-personally identifiable records of the medical surveillance examinations acquired in Section E.4 of these guidelines should be made available on written request to authorized physicians and medical consultants for epidemiological purposes. The record of individuals will, as is usual, be furnished upon request to their private physician.

E6. Epidemiologic Studies

Past use of lasers has generally been stringently controlled. Actual exposure of laser workers has been minimal or even nonexistent. It is not surprising that acute accidental injury has been rare and that the few reports of repeated eye examinations have not noted any chronic eye changes. For these reasons, the examination requirements of this standard are minimal. However, animal experiments with both laser and narrow-band radiation indicate the potential for chronic damage from both subacute and chronic exposure to radiation at certain wavelengths. Lens opacities have been produced by radiation in the 0.295 to 0.45 μm range and are also theoretically possible from 0.75 to 1.4 μm .

Photochemical retinitis appears to be inducible by exposure to 0.35 to 0.5 μm radiation. If laser systems are developed that require chronic exposure of laser workers to even low levels of radiation at these wavelengths, it is recommended that such workers be included in the long-term epidemiologic studies and have periodic examinations of the appropriate eye structures.

Epidemiologic studies of workers with chronic skin exposure to laser radiation (particularly ultraviolet) are suggested.

E7. References

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Table E1
Representative List of Photosensitizing Agents

Agent	Reaction
1 Sulfanamide	Phototoxic Photoallergic
2 Sulfonylurea	Phototoxic
3 Chlorthiazides	Papular and Edematous Eruptions Plaques
4 Phenothiazines	Exaggerates Sunburn Urticaria Gray-Blue Hyperpigmentation
5 Antibiotics, e.g., Tetracycline	Exaggerates Sunburn Phototoxic
6 Griseofulvin	Exaggerates Sunburn Phototoxic Photoallergic
7 Nalidixin Acid	Erythema Bullae
8 Furocoumarins (Psoralen)	Erythema Bullea Hyperpigmentation
9 Estrogens/Progestones	Melasma Phototoxic
10 Chlordiazepoxide (Librium)	Eczema
11 Triazetyldiphenolisatin (Laxative)	Eczematous Photoallergic Reaction
12 Cyclamates	Phototoxic Photoallergic
13 Porphyrins (Porphyria)	Phototoxic
14 Retin-A (Retinoic Acid)	Exaggerates Sunburn Photoallergic

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